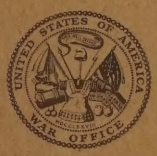
DEPARTMENT OF THE ARMY TECHNICAL MANUAL

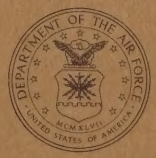
DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER

TM 11-260

TO 31R2-3SCR616-1

RADIO SET SCR-616





DEPARTMENTS OF THE ARMY AND THE AIR FORCE

DECEMBER 1955

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT

DON'T TAKE CHANCES!

EXTREMELY DANGEROUS VOLTAGES EXIST IN THE FOLLOWING UNITS:

Power Supply Unit RA–61–A	600-volt circuits
Radio Receivers R–593/GRR, BC–1269–A, BC–1269	250-volt circuits

TECHNICAL MANUAL
No. 11-260
TECHNICAL ORDER
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DEPARTMENTS OF THE ARMY AND
THE AIR FORCE
WASHINGTON 25, D. C., *22 December 1955*

RADIO SET SCR-616

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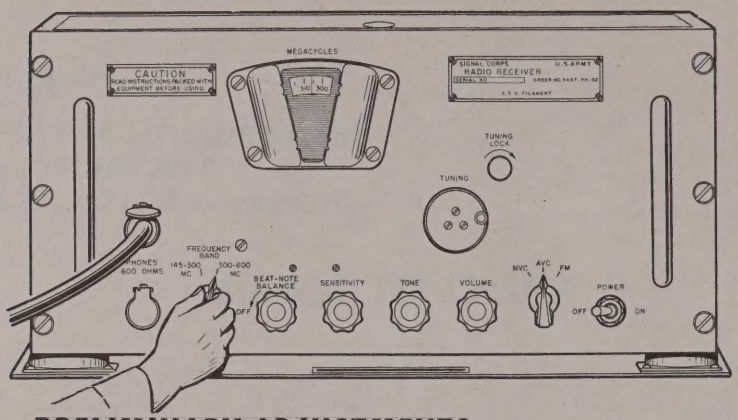
***This manual supersedes TM-11-260, 21 June 1945, including C 1, 13 March 1946, and C 2, 30 April 1952.**

CONDENSED OPERATING INSTRUCTIONS FOR RADIO SET SCR-616



PRELIMINARY ADJUSTMENTS

1. Set receiver controls as follows:

Control	Position
AUDIO HIGH-LOW	High
FREQUENCY BAND	Desired range
MVC-AVC-FM	Desired type of operation
TONE	Full counter-clockwise
BEAT-NOTE BALANCE	OFF
SENSITIVITY	Full clockwise
VOLUME	Midposition

STARTING

1. Place POWER switch to ON position.
2. Turn TUNING knob to desired frequency and turn knob slowly back and forth until the signal is picked up.
3. Adjust SENSITIVITY and VOLUME controls for proper signal strength.

OPERATION

1. Am Signals
   a. Set MVC-AVC-FM switch in AVC position.
   b. Adjust SENSITIVITY and VOLUME for proper output level.
   c. Adjust TONE control as required to improve reception.
2. Fm Signals
   a. Set MVC-AVC-FM switch in FM position.
   b. Adjust SENSITIVITY and VOLUME for proper output level.
   c. Adjust TONE control as required to improve reception.
3. Cw Signals
   a. Set MVC-AVC-FM switch to MVC.
   b. Turn BEAT-NOTE BALANCE CONTROL clockwise from the OFF position and adjust for minimum 1,000 cycle tone with no signal.
   c. Tune in the desired signal which is modulated with a 1,000 cycle tone.
   d. Adjust SENSITIVITY and VOLUME for proper output level.
   e. Adjust TONE control as required to improve reception.

STOPPING PROCEDURE

1. Set POWER switch to OFF.

TM260-107

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual contains instructions for the installation, operation, maintenance and repair of Radio Set SCR–616 (fig. 1).

b. Official nomenclature followed by (*) is used to indicate all models of the equipment covered in this manual. Thus, Headset HS–30–(*) represents Headset HS–30–A through Headset HS–30–U.

c. Throughout the text of this manual, the word *receiver* refers equally to Radio Receivers BC–1269, BC–1269–A, and R–593/GRR which are part of the SCR–616.

d. Forward comments on this publication directly to Commanding Officer, The Signal Corps Publications Agency, Fort Monmouth, N. J.

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of Army equipment and when performing preventive maintenance:

a. DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745–45–5 (Army); Navy Shipping Guide, Article 1850–4 (Navy); and AFR 71–4 (Air Force).

b. DA Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer, as prescribed in AR 700–38.

c. DD Form 535, Unsatisfactory Report, will be filled out and forwarded to Commanding General, Air Materiel Command, Wright-Patter-

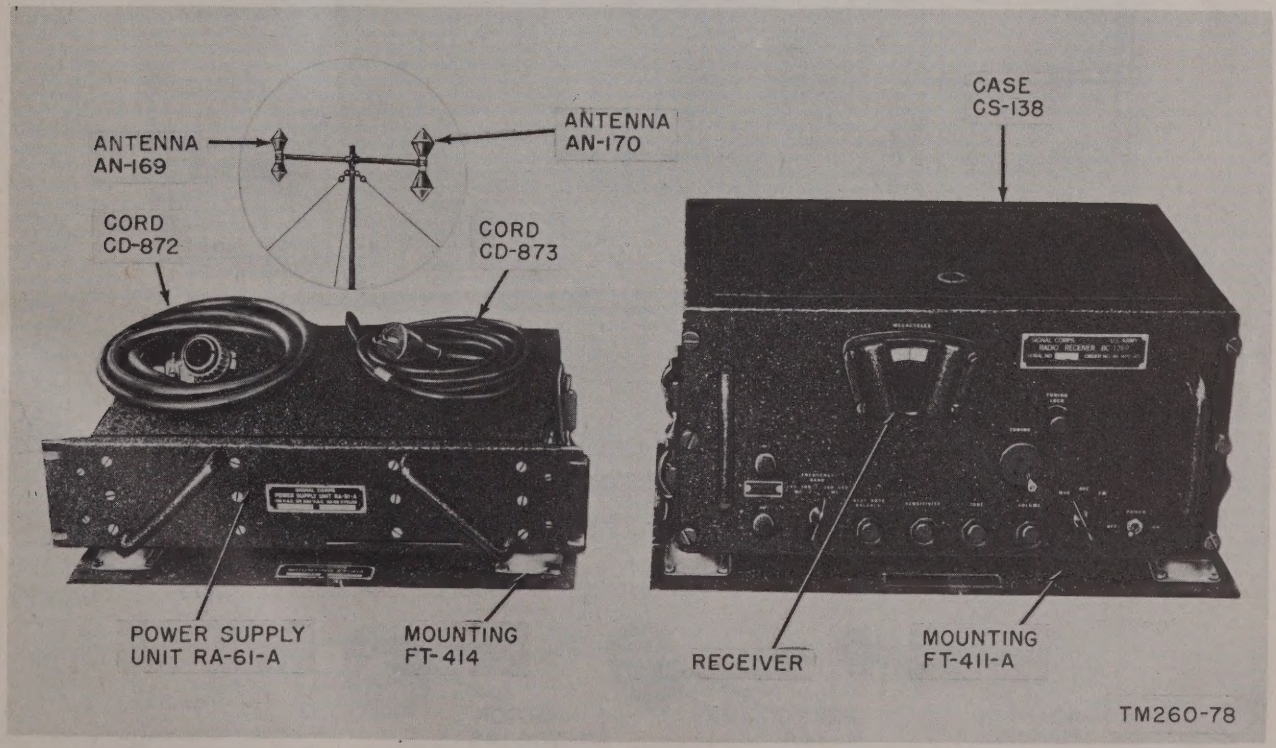


Figure 1. Radio Set SCR–616.

son Air Force Base, Dayton, Ohio, as prescribed in SR 700–45–5 and AF TO 00–35D–54.

d. DA Form 11–238, Operator First Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form (fig. 14).

e. DA Form 11–239, Second and Third Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form (fig. 15).

Section II. DESCRIPTION AND DATA

3. Purpose and Use

Radio Set SCR–616 is a radio receiving system which is to be used to intercept and monitor radio signals in the very-high-frequency (vhf) and ultra-high-frequency (uhf) range. In general, the system is used over an unobstructed line-of-sight transmission path.

a. The equipment is contained in three chests and consists of Antenna Equipment RC–281, a receiver, and Power Supply Unit RA–61–A. The contents of the chests are shown in figures 2, 3, and 4.

b. The receiver is a superheterodyne type with individual antenna inputs for each of two bands. The low-frequency (lf) band covers the range from 145 to 300 megacycles (mc); the high-frequency

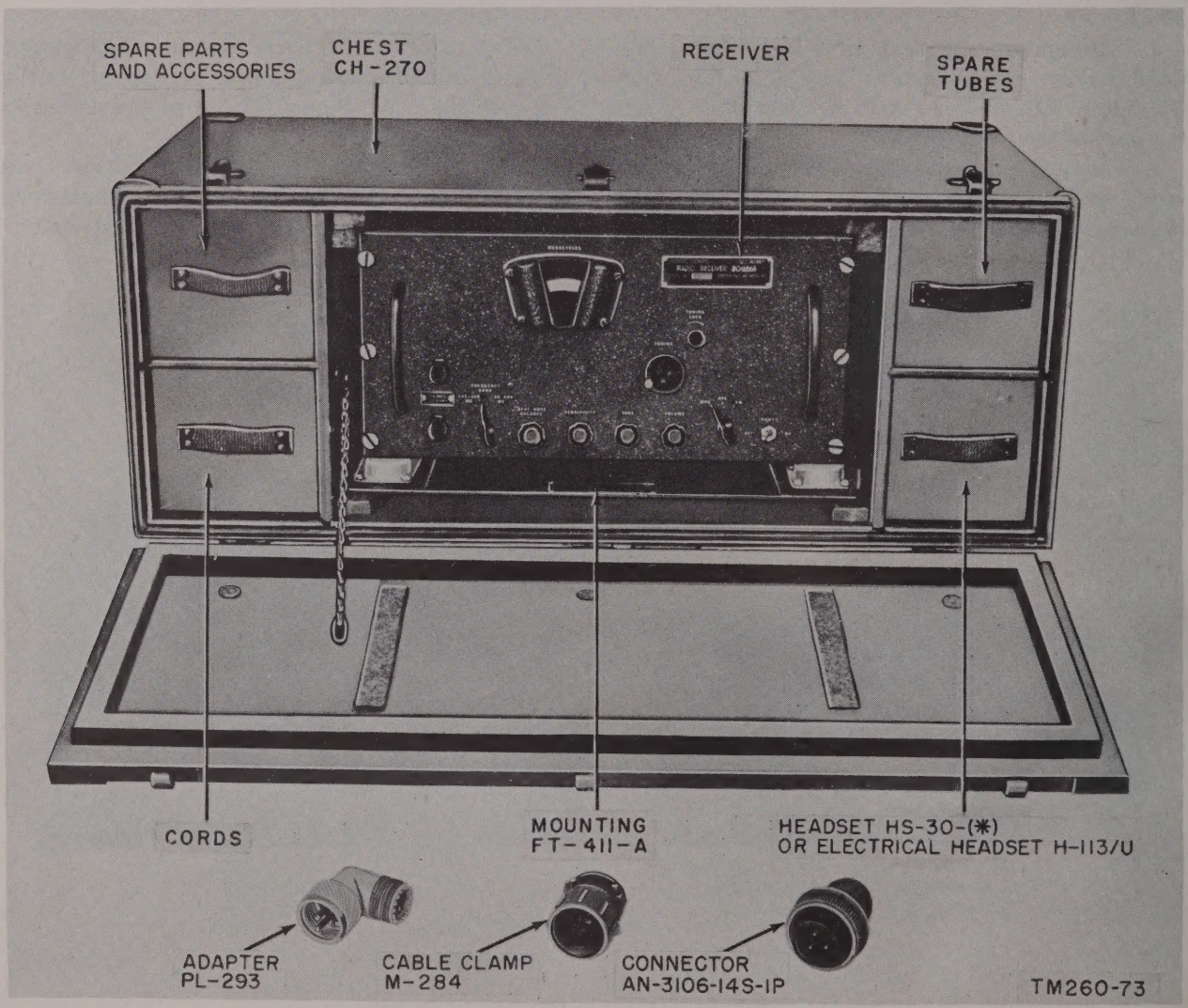


Figure 2. Chest CH–270 and contents.

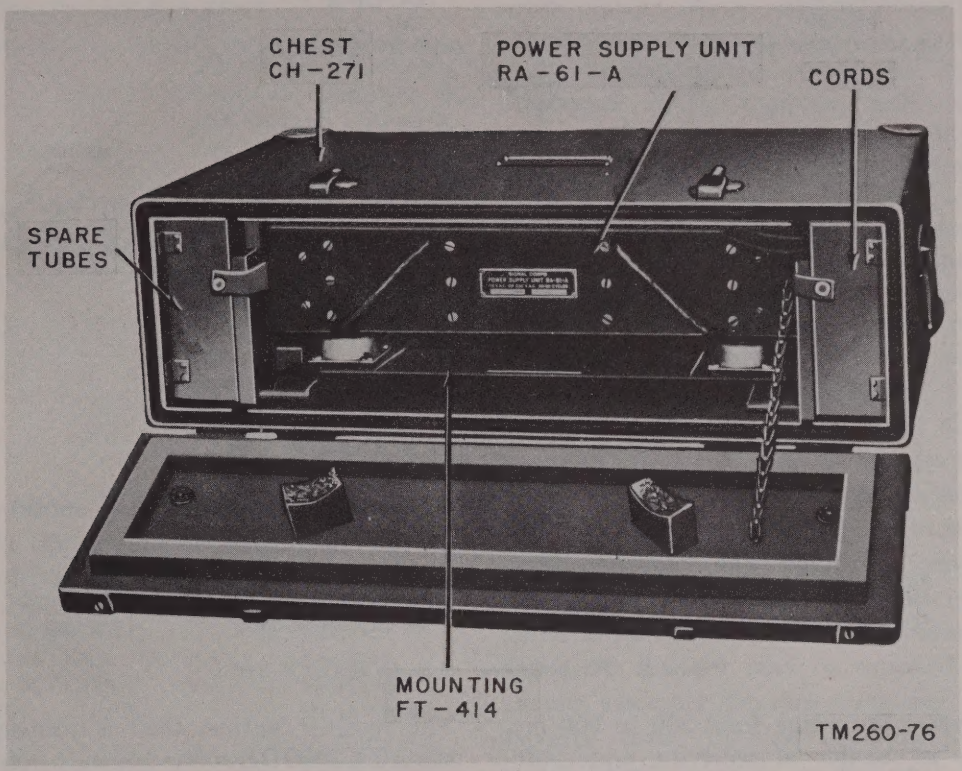


Figure 3. Chest CH-271 and contents.

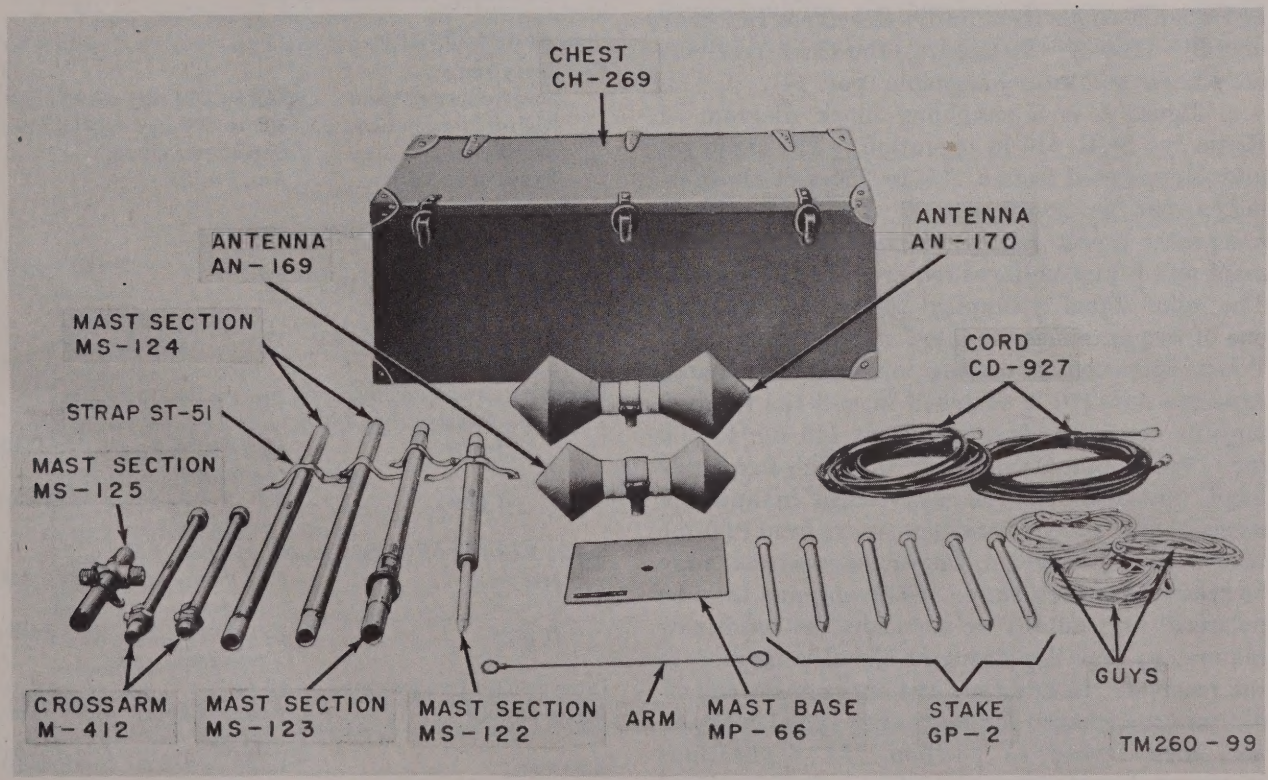


Figure 4. Chest CH-269 and contents.

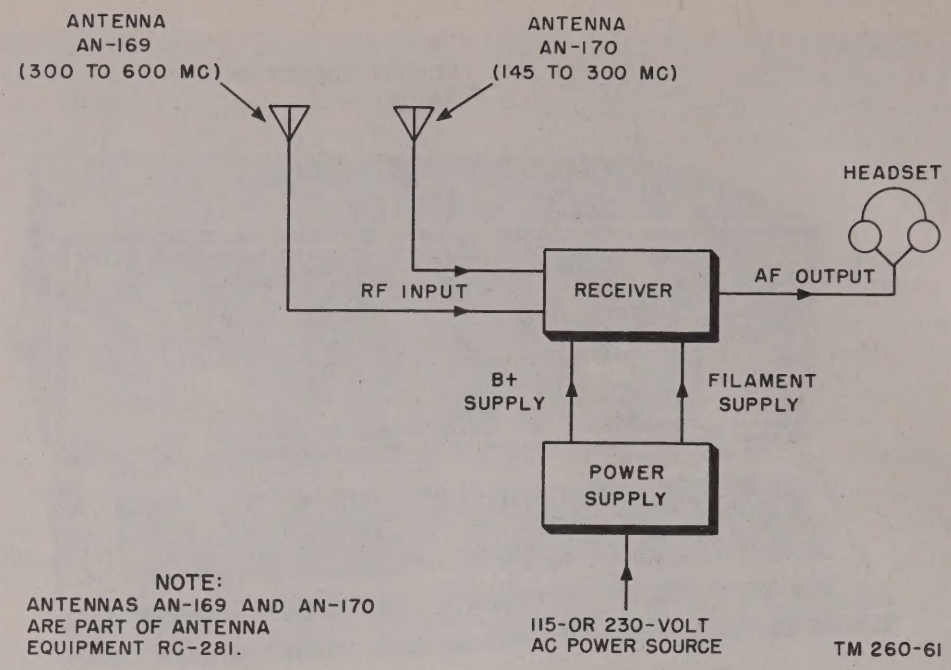


Figure 5. Block diagram of Radio Set SCR–616.

(hf) band covers the range from 300 to 600 mc. The receiver is capable of receiving amplitude-modulated (am), frequency-modulated (fm), or continuous-wave (cw) signals. Radio Receiver R–593/GRR incorporates certain improvements and modifications over Radio Receivers BC–1269 and BC–1269–A. In general, the three receivers are similar and interchangeable (par. 14).

c. Figure 5 is a simplified block diagram of Radio Set SCR–616 in operation. The radio set may be operated from a 115- or 230-volt alternating current (ac) power source. The radio set uses a separate power supply which supplies the filament and B plus voltages required by the receiver. The input signal is supplied to the receiver from one of two antennas mounted on a common mast. When operation is on the low-frequency band, Antenna AN–170 is switched in and the receiver may be continuously tuned from 145 mc to 300 mc. When operation is on the high-frequency band, Antenna AN–169 is switched in and the receiver may be continuously tuned from 300 mc to 600 mc. Either am, fm, or cw reception may be selected on each band. Each antenna may be polarized horizontally or vertically, as conditions require, so that the strongest signal is applied to the receiver. In addition, the entire mast assembly may be rotated for maximum signal pick-up, and then staked in position. In applications requiring that the direction of an unknown signal be determined, a directional antenna is required. The receiver output then is connected through the AUX DIODE connector to the direction finder (df) indicating equipment.

4. Technical Characteristics

a. Radio Receiver.

Frequency range:	
Low-frequency band	145 to 300 mc, continuous.
High-frequency band	300 to 600 mc, continuous.
Receiver type	Superheterodyne.
Types of reception	Am, cw, fm.
Number of tubes:	
Radio Receiver BC–1269.	17.
Radio Receiver BC–1269–A.	18.
Radio Receiver R–593/GRR.	17.
Power requirements:	
Radio Receiver BC–1269:	
Heater	12.6 volts ac or dc, 2.45 amperes.
B plus	250 volts dc, 106 milliamperes.
Radio Receivers BC–1269–A and R–593/GRR:	
Heater	6.3 volts ac or dc, 4.9 amperes.
B plus	250 volts dc, 106 milliamperes.
Intermediate frequency	15 mc.
Power supply	Power Supply Unit RA–61–A.
Antenna	Uses Antenna Equipment RC–281.
Weight	44 lb.

b. Power Supply Unit RA–61–A.

Power requirements	115 volts ac, .85 ampere. 230 volts ac, .45 ampere.
Power output	6.3 volts ac, 6 amperes, or 12.6 volts ac, 3 amperes. 250 volts dc, 120 milliamperes.

c. Antennas AN–169 and AN–170 (Part of Antenna Equipment RC–281).

Type, each	Half-wave, center-fed biconical.
Frequency range	145 mc to 300 mc (AN–170). 300 mc to 600 mc (AN–169).
Length	23¾ inch (AN–170). 16 35/64 inch (AN–169).

5. Common Name Assignments

A list of the common name assignments for the components of Radio Set SCR–616 is given below

Nomenclature	*Common name*
Radio Receiver R–593/GRR	Receiver.
Radio Receiver BC–1269	Receiver.
Radio Receiver BC–1269–A	Receiver.
Antenna AN–169	Hf antenna.
Antenna AN–170	Lf antenna.
Power Supply Unit RA–61–A	Power supply.

6. Packaging Data

(fig. 9)

a. When packaged for export, all components of Radio Set SCR–616 are stored within three separate chests. Each chest is suitably cushioned on all surfaces to protect the unit from shock normally encountered in handling and transit. Each cushioned chest, together with the required amount of desiccant, is placed within a commercial grade corrugated fiberboard box, and then covered with a water-vaporproof barrier. The chest is then placed in a water-resistant fiberboard box which is sealed with water-resistant pressure-sensitive tape. The radio set is then packed in wood cleated plywood, nailed wood, or wirebound boxes. The shipping containers are strapped with steel straps applied girthwise.

b. When packaged for domestic shipment, the components of the radio set are packaged as for export except that wooden boxes are not used. The equipment may be shipped in its own three chests without any additional covering. The dimensions and volume for the three chests are given in paragraph 7. For fixed-station applications, the receiver may be supplied as a panel-chassis assembly for rack-mounting without the receiver case. In this instance, the receiver-panel-chassis assembly is packaged as shown in figure 9. The antennas and power supply are not supplied when the panel-chassis assembly is shipped alone, as these equipments are usually available as part of the fixed-station installation.

7. Table of Components

(figs. 2–4)

Component	Required No.	Height (in.)	Depth (in.)	Length (in.)	Volume (cu ft)	Unit weight (lb)
Chest CH–270, including	1	15	18	37½	6	
Receiver	1				1. 4	44
Cable Clamp M–284	1	15/16	15/16	1 5/64		
Case CS–138	1	8¾	13 3/16	20	1. 3	18¼
Connector AN–3106–14S–1P	1	1 1/16	1 1/16	1 1 1/16		
Cord CD–605 or Cord CD–307–A[a]	2			78		
Headset HS–30–(*) or Electrical Headset H–113/U [a]	2					
Mounting FT–411–A	1	3⅞	13⅝	21¼	. 65	11
Technical manual TM 11–260	2					
Chest CH–271	1	9¾	18	30¼	3	
Power Supply Unit RA–61–A	1	4	13⅞	19	. 55	
Cord CD–872	1			84		
Cord CD–873	1			120		
Fuse, 1½ amp at 230 volts	4					
Fuse, 3 amp at 115 volts	4					
Mounting FT–414	1	3½	11¾	18¼	. 42	
Chest CH–269	1	14	17½	50¼	7. 8	

[a] Cord CD–307–A and Electrical Headset H–113/U are used with Radio Receivers BC–1269–A and R–593/GRR. Cord CD–605 and Headset HS–30–(*) are used with Radio Receiver BC–1269.

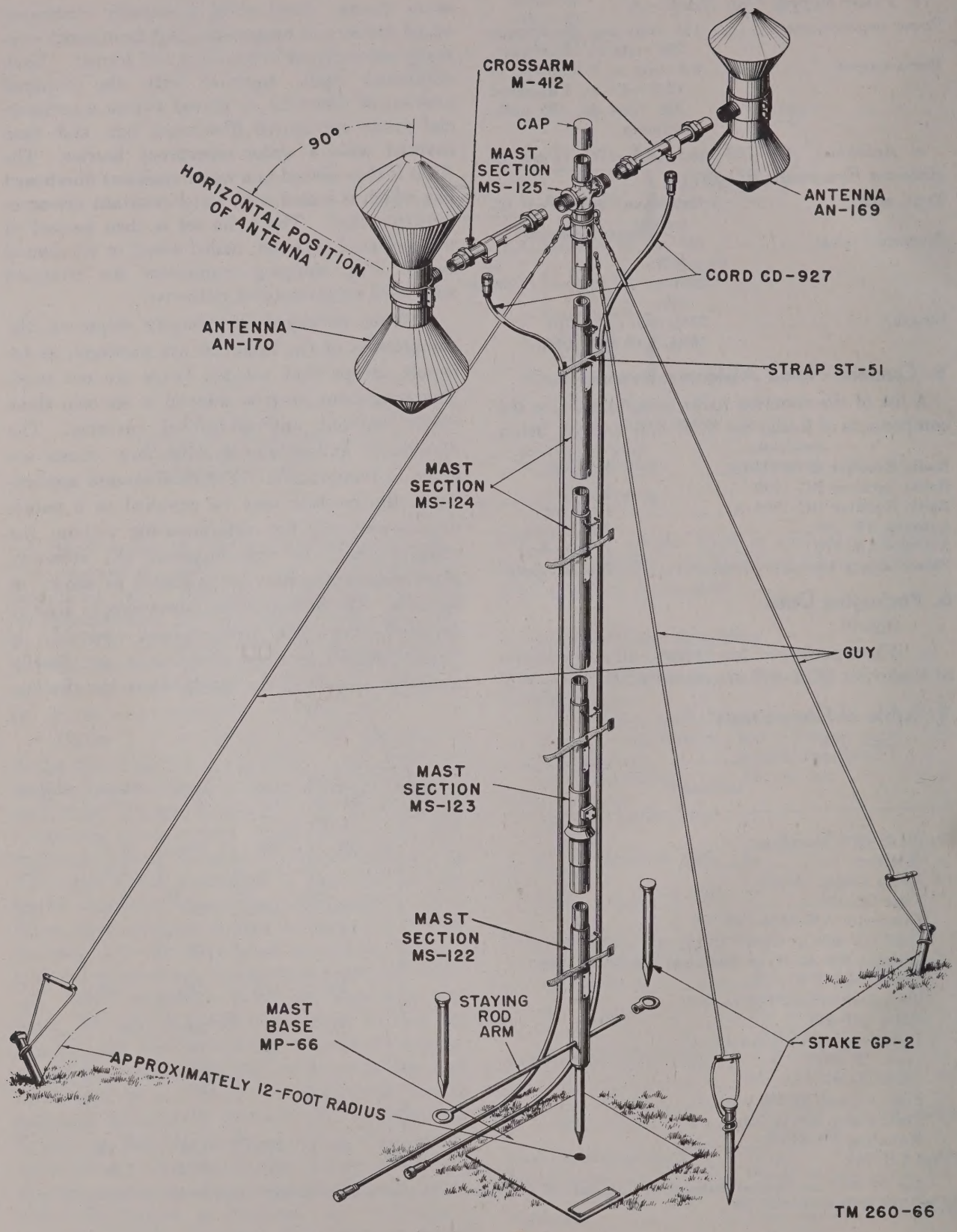


Figure 6. Antenna Equipment RC–281, assembly drawing.

Component	Required No.	Height (in.)	Depth (in.)	Length (in.)	Volume (cu ft)	Unit weight (lb)
Antenna Equipment RC–281, including:						
Adapter PL–293	1			1 13/64		
Arm, staying rod	1			21		½
Antenna AN–169	1			16		2½
Antenna AN–170	1			22½		3
Cap	1			3¼		
Cord CD–927	2			360		3½
Crossarm M–412	2			24		2½
Guy rope	3			300		½
Mast Base MP–66	1			12		5½
Mast Section MS–122	1			41		6
Mast Section MS–123	1			47		6
Mast Section MS–124	2			47		4½
Mast Section MS–125	1			13¾		4
Stake GP–2	[b] 5			16		2
Strap ST–51	[b] 4			10		
Total					21. 12	113¾

Note. This list is for general information only. See appropriate supply publications for information pertaining to requisition of spare parts.

[b] Six Stakes GP–2 and eight straps are packed with the equipment.

8. Description of Receiver

(figs. 1 and 13)

a. The receiver is a superheterodyne type covering the frequency range from 145 to 300 mc in the lf band and 300 to 600 mc in the hf band. It is capable of receiving am, fm, or cw signals over its entire range. The receiver chassis is fastened to the front panel, and both may be removed from the case for rack mounting.

b. All operating controls, except the AUDIO switch, are located on the front panel. The front panel also contains two headset jacks with cover caps.

c. Connectors for the antennas, POWER input, AUX DIODE output, and the OUTPUT terminal strip are located on the rear of the receiver chassis. The AUDIO switch is also located on the rear of the receiver chassis.

d. The receiver has two separate radio-frequency (rf) sections, one for each band. Automatic volume control (avc) and a tone injection oscillator for cw reception are also provided. Provision is made for using the receiver with auxiliary df equipment. Where such an application is indicated, the direction finder indicating equipment is connected to the AUX DIODE connector located on the rear of the receiver chassis.

e. Radio Receiver BC–1269 requires a 12.6-volt filament supply; Radio Receivers BC–1269–A and R–593/GRR require a 6.3-volt filament supply.

9. Description of Antenna Equipment RC–281

(fig. 6)

a. Antenna Equipment RC–281 consists of two biconical antennas, two cross arms, five mast sections, two coaxial transmission lines, three guy ropes, six stakes, a mast base, a staying rod arm, and eight straps.

b. Both antennas are center-fed biconicals. The mast is assembled to form a T-type structure with Antennas AN–170 and AN–169 mounted on the ends of the cross arms. The antennas may be positioned in either a vertical or horizontal position.

c. Three guy ropes are fastened through rings on a sleeve which permits the mast assembly to rotate freely. When the antenna mast is turned to the desired position, it can be held fixed by driving stakes through the eyes of the staying rod arm which is inserted through a mast section.

10. Description of Power Supply Unit RA–61–A

(figs. 1 and 10)

a. Power Supply Unit RA–61–A uses a full-wave rectifier circuit which supplies plate and screen potentials to the receiver. The power

supply also supplies ac heater voltage for the tubes in the receiver. The front panel of the case in which the power supply is contained has slots for mounting in a relay rack. When not rack-mounted, the unit is mounted on Mounting FT–414. Cord CD–873 connects the power supply to the power source. Cord CD–872 connects the power supply to the receiver.

b. The power supply may be operated from either a 115- or 230-volt ac power source. The filament voltage selected may be either 6.3 or 12.6 volts ac, depending on the receiver in use (par. 14). The power supply has two 5U4G rectifier tubes; one in use and one spare. Two toggle switches are provided inside the power supply which select the proper input voltage connections and output filament voltage. Each switch is labeled and is provided with a locking device.

c. The power supply is protected from overload by one of two fuses. For 115-volt operation a 3-ampere fuse is used; for 230-volt operation a 1½-ampere fuse is used. The fuses are located near the toggle switches at the rear of the power supply. There are no operating controls on the front panel of the power supply. The application of power to the power supply is controlled by the POWER switch on the front panel of the receiver.

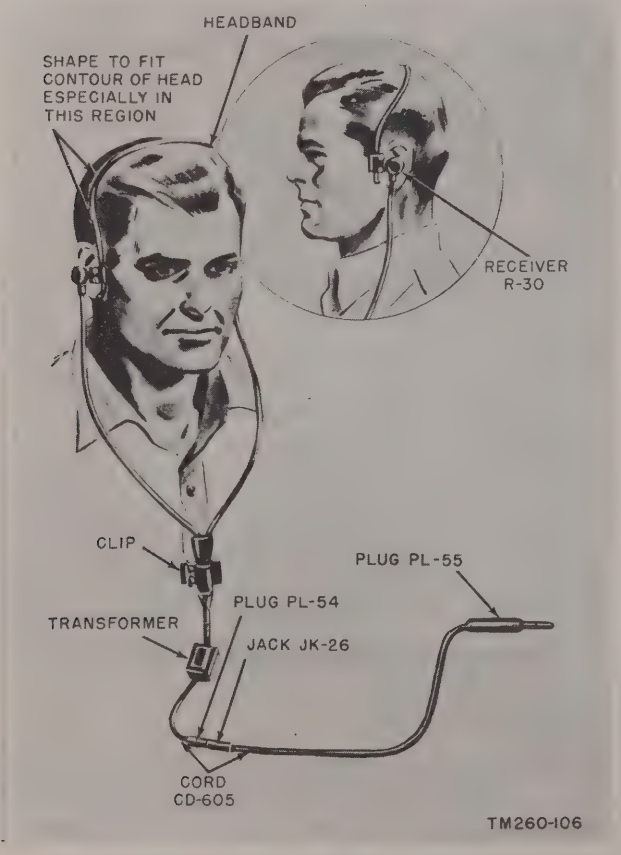


Figure 7. Headset HS–30(*) in use.

Caution: Before connecting Power Supply Unit RA–61–A to the receiver, be sure that switch S201 is set to the proper line-voltage position. Also, be sure that switch S202 is set to provide the correct filament voltage for the receiver in use (par. 14).

11. Radio Set SCR–616, Equipment Chests

a. Chest CH–270. The receiver is packed in Chest CH–270 for storage and transportation. This chest also provides space for headset Cord CD–605, Headset HS–30–(*) or Electrical Headset H–113/U, and Cord CD–307–A, Mounting FT–411–A, technical manuals, and spare tubes for the receiver (fig. 2).

b. Chest CH–271. Power Supply Unit RA–61–A is packed, for storage and transportation, in Chest CH–271. This chest also contains Mounting FT–414 and spare tubes for the power supply (fig. 3).

c. Chest CH–269. When stored or transported, the components of Antenna Equipment RC–281 are packed in Chest CH–269 (fig. 4). The components are held in place securely by canvas straps and wooden clamping blocks.

12. Description of Minor Components and Accessories

a. Mounting FT–411–A. This is a special shockproof mounting made for use with the receiver (fig. 1). It has a steel bedplate and rubber shock mounts to which are bolted two support angles. On the angles are four catches which clamp to the hooks on the receiver case.

b. Mounting FT–414. Mounting FT–414 is a special shockproof steel mounting (fig. 1) made for use with the power supply. It is equipped with rubber shock mounts to which are bolted two support angles. Two catches are mounted on each angle for clamping to the hooks on the power supply housing.

c. Headset HS–30–(*). Headset HS–30–(*) is a lightweight, close-fitting headset (fig. 7). Special soft rubber earpieces snapped to the receivers of the headset are designed to fit snugly into the ear cavities and exclude outside noises. The headband is of thin steel that is adjustable to the contours of the operator's head. The clip on the headset should be attached to the operator's clothing to relieve the pull on the headset cord. The HS–30–(*) has a 250-ohm impedance. Cord

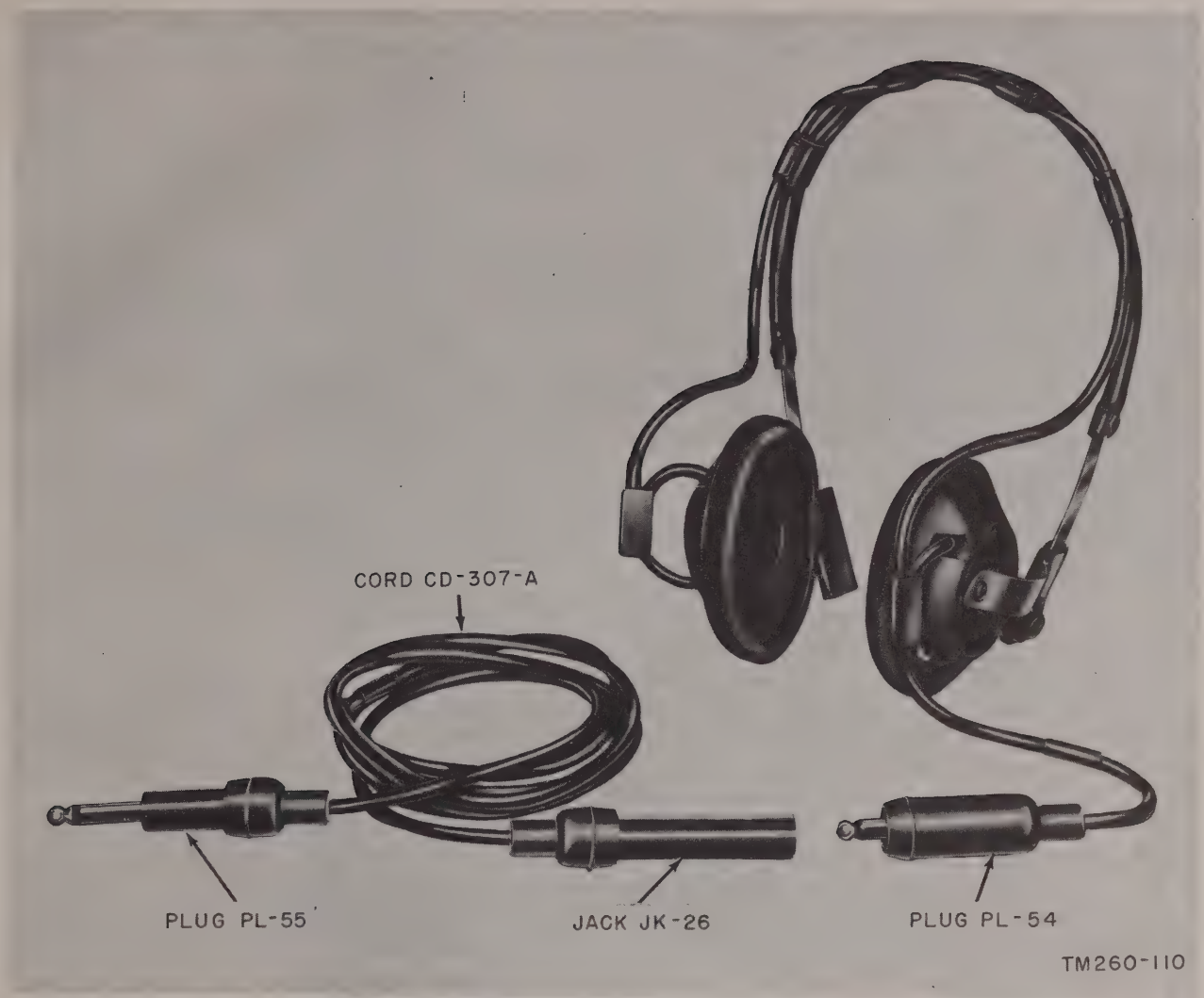


Figure 8. Electrical Headset H–113/U and Cord CD–307–A.

CD–605, which contains a matching transformer, is used to match the headset to the 4,000-ohms output impedance of Radio Receiver BC–1269.

d. Electrical Headset H–113/U. This is a close-fitting headset equipped with the necessary cording and connecting plug (fig. 8). The impedance of the headset is 600 ohms. It consists of two wafer-type, series-connected, 300-ohm receivers with synthetic rubber ear cushions. The headband should be adjusted to the head by positioning the ear cushions to minimize external noise. The impedance of this headset matches the 600-ohm output impedance of Radio Receivers BC–1269–A and R–593/GRR.

e. Cord CD–872. This is a 7-foot shielded cord covered with a weatherproof jacket (figs. 1 and 10). It contains six conductors: two for the POWER switch, two for the B plus supply voltage, and two for the heater supply voltage. The cord is part of Power Supply Unit RA–61–A and is connected to screw terminals on the rear of the unit. The plug on the other end connects to the power connector on the rear apron of the receiver.

f. Cord CD–873. This is a 10-foot, two-conductor cord with an overall weatherproof covering (figs. 1 and 10). It connects the power unit to the ac power line and is supplied connected to the power unit. A male plug at one end connects to the ac power line socket; the other end connects to the power unit by means of solder lugs. These are held under screw-type terminals on the rear panel of the power unit near the line-voltage switch.

g. Cords CD–927. These are 30-foot shielded-pair transmission lines which connect the antennas

to the receiver (fig. 4). One connects Antenna AN–170 to the ANT 145–300 receptacle on the rear of the receiver chassis; the other connects Antenna AN–169 to the ANT 300–600 receptacle. These cords contain two parallel inner conductors inside a braided shield, providing a nearly perfectly balanced line.

h. Cord CD–307–A. This is a general purpose headset cord consisting of two color-coded insulated conductors. It is fitted with a Plug PL–55 on one end and Jack JK–26 on the other end for connecting with Electrical Headset H–113/U.

i. Cord CD–605. This is a 6½-foot extension cord for use with Headset HS–30–(*) (fig. 7). It contains two conductors in a weatherproof jacket, and is terminated in a matching transformer at one end and Plug PL–55 at the other.

j. Accessories. The following accessories are supplied with Radio Set SCR–616 (fig. 2): Adapter PL–293, Cable Clamp M–284, and Connector AN–3106–14S–1P. When the receiver is supplied as a panel-chassis assembly, less case, two Adapters P1–293 are supplied. Cable Clamp M–284 and Connector AN–3106–14S–1P are located in Chest CH–270. Adapter PL–293 is located in Chest CH–269. Connector AN–3106–14S–1P is a three-pronged plug connector which is used with Cable Clamp M–284 when connecting the direction finder indicating equipment to the AUX DIODE connector on the rear of the receiver chassis. Adapter PL–293 is a right-angle adapter plug for use with Cord CD–927.

13. Running Spares

A group of running spares is provided with each Radio Set SCR–616. Spare tubes and pilot lights for the receiver and spare tubes for the power supply are contained in the chests which house these units. An additional spare tube for the power supply is mounted near the tube in use inside the right rear door of the power supply (fig. 10). Spare fuses for the power supply are located inside the left rear door of the power supply. A spare output connector J201 and Cable Clamp M–293 for the power supply unit are located in the receiver chest (Chest CH–270). A spare Plug PL–284 (Radio Frequency Plug UG–102/U) for Cord CD–927 is located in the antenna equipment chest (Chest CH–269). Because the three models of the receiver do not use the same number or types of tubes, the spare tubes for each receiver are different. The following are lists of additional running spares:

a. Radio Receiver BC–1269.
- 1 tube, type OD3
- 2 tubes, type 7G8
- 1 tube, type 12A6
- 1 tube, type 12H6
- 1 tube, type 12SH7
- 1 tube, type 12SL7
- 1 tube, type 955
- 1 tube, type 9002
- 1 tube, type 9005
- 2 pilot lamps, 12–16 v, 1 amp, miniature bayonet base

b. Radio Receiver BC–1269–A.
- 1 tube, type OD3
- 1 tube, type 6AG5
- 1 tube, type 6H6
- 1 tube, type 6J6
- 2 tubes, type 6SH7
- 1 tube, type 6SL7
- 1 tube, type 6V6
- 1 tube, type 955
- 1 tube, type 9002
- 1 tube, type 9005
- 2 pilot lamps, 6–8 v, .15 amp, miniature bayonet base

c. Radio Receiver R–593/GRR.
- 1 tube, type OD3
- 1 tube, type 6H6
- 2 tubes, type 6J6
- 1 tube, type 6SH7
- 1 tube, type 6SL7
- 1 tube, type 6V6
- 1 tube, type 955
- 1 tube, type 9002
- 1 tube, type 9005
- 2 pilot lamps, 6–8 v, .15 amp, miniature bayonet base

d. Power Supply RA–61–A.
- 1 5U4G
- 3 fuses, 3-ampere, 250v, cartridge, 1½ in. long by ¼ in. diameter.
- 3 fuses, 1½-ampere, 250 v, 1 in. long by ¼ in. diameter
- 1 output Connector AN–3108–22–5S, 6 contact, female, polarized
- 1 Cable Clamp M–293

e. Antenna Equipment RC–281.
- 1 Radio Frequency Plug UG–102/U (Plug PL–284)

14. Differences in Models

The external appearance of the three models of the receiver is identical in all respects. The later

models have been modified to improve operational features. All receivers are interchangeable.

a. Rf Section. In Radio Receiver BC–1269, the shield which covers the rf section of the receiver must be removed when alining the receiver. In Radio Receivers BC–1269–A and R–593/GRR, access holes with removable snap covers are provided in the rf shield to permit the insertion of a tuning wand during the alinement process (fig. 39).

b. Filament Votages. Radio Receiver BC–1269 requires 12.6 volts ac or direct current (dc) for the tube filaments. Radio Receivers BC–1269–A and R–593/GRR require a 6.3-volt ac or dc supply. Power Supply Unit RA–61–A fulfills the requirements for all models of the receiver provided switch S202, marked 6.3V–12.6V, is set in the proper position.

c. Tube Complement. The individual stages in each of the receivers accomplish the same function; however, the following differences in tube complement exist.

(1) Radio Receiver BC–1269, the lf. rf amplifier, is a push-pull stage using a duotetrode, tube type 7G8. The lf. rf amplifier in Radio Receiver BC–1269–A uses two pentodes, type 6AG5, in this circuit; Radio Receiver R–593/GRR uses a duotriode tube type 6J6.

(2) In Radio Receiver BC–1269, the lf. mixer uses a duotetrode, tube type 7G8. In Radio Receiver BC–1269–A and R–593/GRR, a duotriode, tube type 6J6, is used.

(3) The audio output stage in Radio Receiver BC–1269 uses a tube type 12A6. Radio Receivers BC–1269–A and R–593/GRR use a tube type 6V6 in this application.

CHAPTER 2
OPERATION

Section I. SERVICE UPON RECEIPT OF RADIO SET SCR–616

15. Siting

The best location for radio equipment depends on the local conditions such as: the need to house the equipment where its shelter cannot be seen; the type of housing available; possible installation in a vehicle; the terrain; and the need of easy access to messengers. The receiver is better able to receive distant signals if the antenna is high and clear of hills, buildings, cliffs, densely wooded areas, and other obstructions. Depressions, valleys, and other low places are poor locations for radio reception because the surrounding high terrain absorbs rf energy. Weak or otherwise undesirable signals may be expected if the set is operated under or close to steel bridges, underpasses, hospitals, power lines, or power units. If possible, choose a location on a hilltop or elevation. Flat ground is desirable. Normally, reception over water is better than over land. See that drainage is adequate to prevent flooding the interior of the shelter. If the equipment is part of a communication center, but is not installed within the center, locate the equipment near by. In locating the antenna, avoid obstructions which are 2° or 3° above the horizontal plane of the antenna in the direction of desired reception. This is approximately 200 to 300 feet at a distance of 1 mile from the antenna.

16. Uncrating, Unpacking, and Checking New Equipment

(fig. 9)

a. General. Equipment may be shipped in oversea packing cases or in domestic packing cases and sometimes in its own chests (Chests CH–269, CH–270, and CH–271). The receiver may be shipped alone as a panel-chassis assembly without the receiver case. This method of shipping is used when the receiver is intended for rack-mounting. When new equipment is received, select a location where the equipment may be unpacked without exposure to the elements and which is convenient to the permanent or semipermanent installation of the equipment. The instructions in *b* below apply to equipment in export packing cases, and the instructions in *c* to equipment in domestic packing cases. Aside from checking to make sure that all three chests are present and that the equipment is undamaged, no special unpacking and uncrating procedures are necessary for equipment shipped in its own chest. Be careful in uncrating, unpacking, and handling the equipment, it is easily damaged. If it becomes damaged or exposed, a complete overhaul might be required or the equipment might be rendered useless. For used or reconditioned equipment, refer to paragraph 21.

b. Step-By-Step Instructions for Uncrating and Unpacking Export Shipments.

(1) Place the wooden packing boxes as near the operating position as convenient.
(2) Avoid thrusting tools into the interior of the shipping containers.
(3) Cut and fold back the steel straps.
(4) Remove the nails with a nail puller. Remove the top and one side of each packing crate. Do not attempt to pry off the sides and top; the equipment may be damaged.
(5) Remove the moistureproof barrier and open the outer corrugated carton.
(6) Remove the second moistureproof barrier and place the inner corrugated carton on the work bench.
(7) Open the inner corrugated carton and remove the moisture-vaporproof barrier and any padding or corrugated paper. Take out the equipment.
(8) Remove the equipment chests from the corrugated cartons.
(9) Inspect the equipment for possible damage incurred during shipment.
(10) Check the contents against the master packing slip.
(11) When the radio receiver is supplied as a panel-chassis assembly without the receiver case, it is packaged as shown in

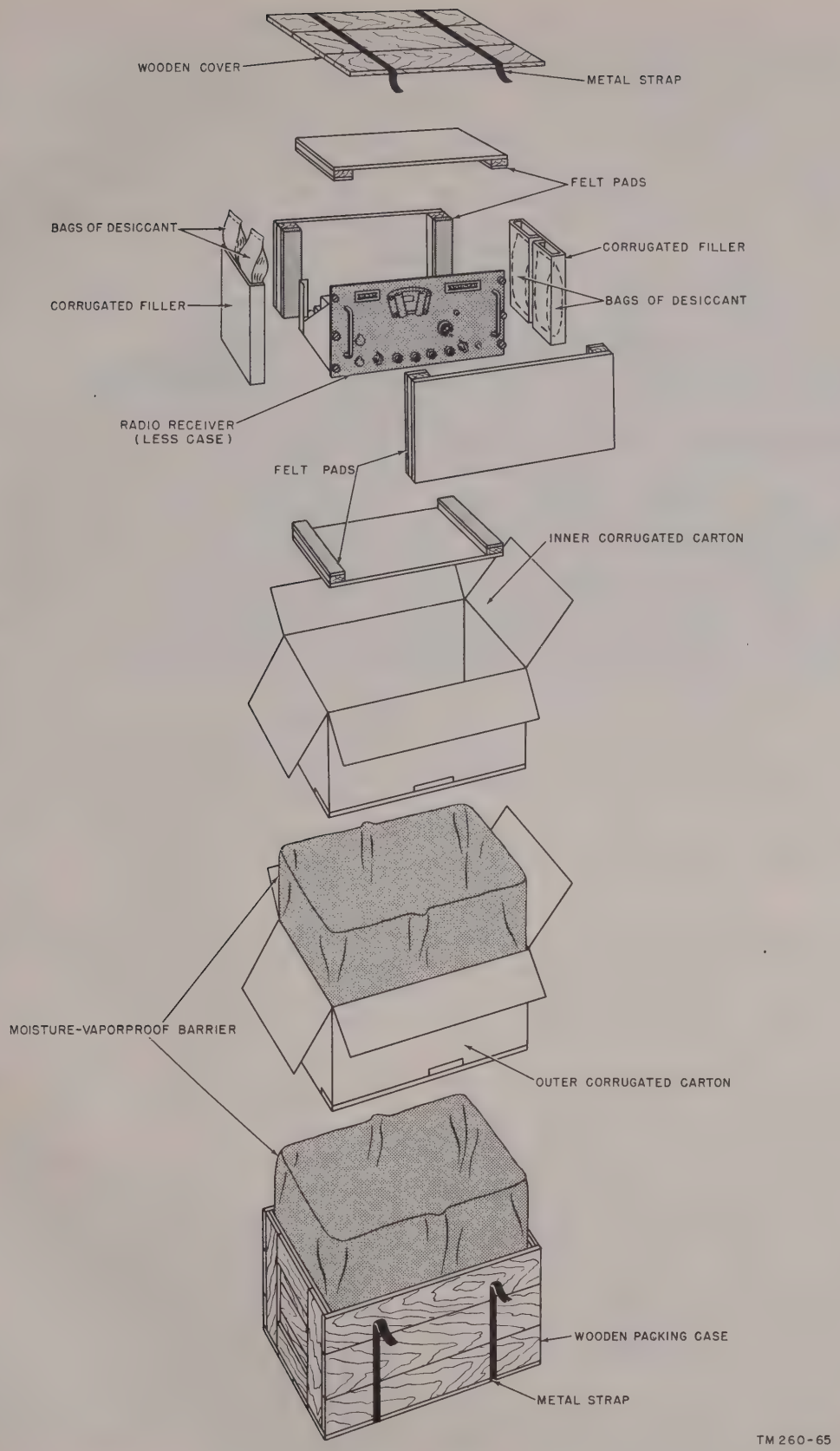


Figure 9. Receiver packaging diagrams.

figure 9. To unpack the receiver panel-chassis assembly, follow the instructions given in (1) through (10) above.

c. Unpacking Domestic Packing Cases.

(1) When the radio set is received in domestic packing cases, open the cartons that protect the equipment and proceed as directed in *b*(7) through (10) above.

(2) When the radio receiver is supplied as a panel-chassis assembly without the receiver case, it is packed as shown in figure 9, except that no wooden packing crate is used. Proceed as directed in *b*(7) through (10) above.

17. Installation of Antenna Equipment RC–281

All components necessary to install a complete antenna are provided in Chest CH–269. Study figure 6 before performing the antenna assembly procedure outlined below.

Caution: When unpacking, keep sand and mud from the ends of the mast sections.

a. Insert the sleeve end of Mast Section MS–124 into Mast Section MS–125. The top of Mast Section MS–125 has an opening which permits the addition of another mast section if greater antenna height is required. Ordinarily, the top of Mast Section MS–125 should be covered with the metal cap provided.

b. Attach the three guy ropes with snap fasteners to the three guy ring eyes on Mast Section MS–125.

c. Successively attach Mast Sections MS–123 and MS–122. Mast Section MS–122 is equipped with a 12-inch ground stake at its bottom end.

d. Insert the stake end of Mast Section MS–122 through the hole in the center of Mast Base MP–66.

e. Lay the antenna mast assembly on the ground and drive Stake GP–2 at the end of the mast which supports the antennas. Repeat this procedure three times using the mast assembly as a radius. Be sure that the three stakes are inserted in the ground approximately 120° apart.

f. Attach Crossarms M–412 to Mast Section MS–125. For horizontal polarization, position the cross arms so that the coaxial connectors are horizontal. For vertical polarization, position the cross arms so that the coaxial connectors are vertical.

g. Attach Cords CD–927 to the coaxial connectors on the cross arms, and fasten the cords to the mast with fabric Strap ST–51 on the mast section.

h. Connect Antennas AN–170 and AN–169 to the ends of the cross arms with the proper polarization.

i. With the spiked end of Mast Section MS–122 in the hole of the Mast Base MP–66, raise the antenna assembly to a vertical position and plunge it down into the ground.

j. Fasten the guy ropes to the three stakes and pull the ropes taut so that the antenna mast assembly is vertical.

k. For horizontal polarization, rotate the antenna mast assembly until the cross arms point to the direction from which signals are arriving. The antenna receives equally well in all directions with vertical polarization.

l. With the antenna properly positioned, insert the staying rod arm through Mast Section MS–122 and drive Stake GP–2 through each eye at the ends of the arm to prevent the antenna from rotating.

18. Installation of Receiver

a. Remove the receiver and Mounting FT–411–A from Chest CH–270 (fig. 2) and place them in a position convenient for operation. If the radio set is to be mounted in a semipermanent installation, the receiver should be removed from Mounting FT–411–A so that the mounting can be fastened securely to a suitable mounting surface. The receiver should then be returned to the mounting and the catches fastened securely.

b. The receiver is designed so that it may be mounted in a standard relay rack. In this case, the receiver panel chassis is removed from Case CS–138 and is fastened in the rack by the six captive panel mounting screws.

19. Installation of Power Supply Unit RA–61–A

a. Remove the power supply and Mounting FT–414 from Chest CH–271 (fig. 3) and place them in a position near the receiver. Be sure that Cord CD–873 will reach the ac power source and that Cord CD–872 will reach the POWER connector on the rear of the receiver. If the radio set is to be mounted in a semipermanent installation, remove the power supply from the mounting so that the mounting can be fastened securely in place. The power supply should then be returned to the mounting and the catches fastened securely.

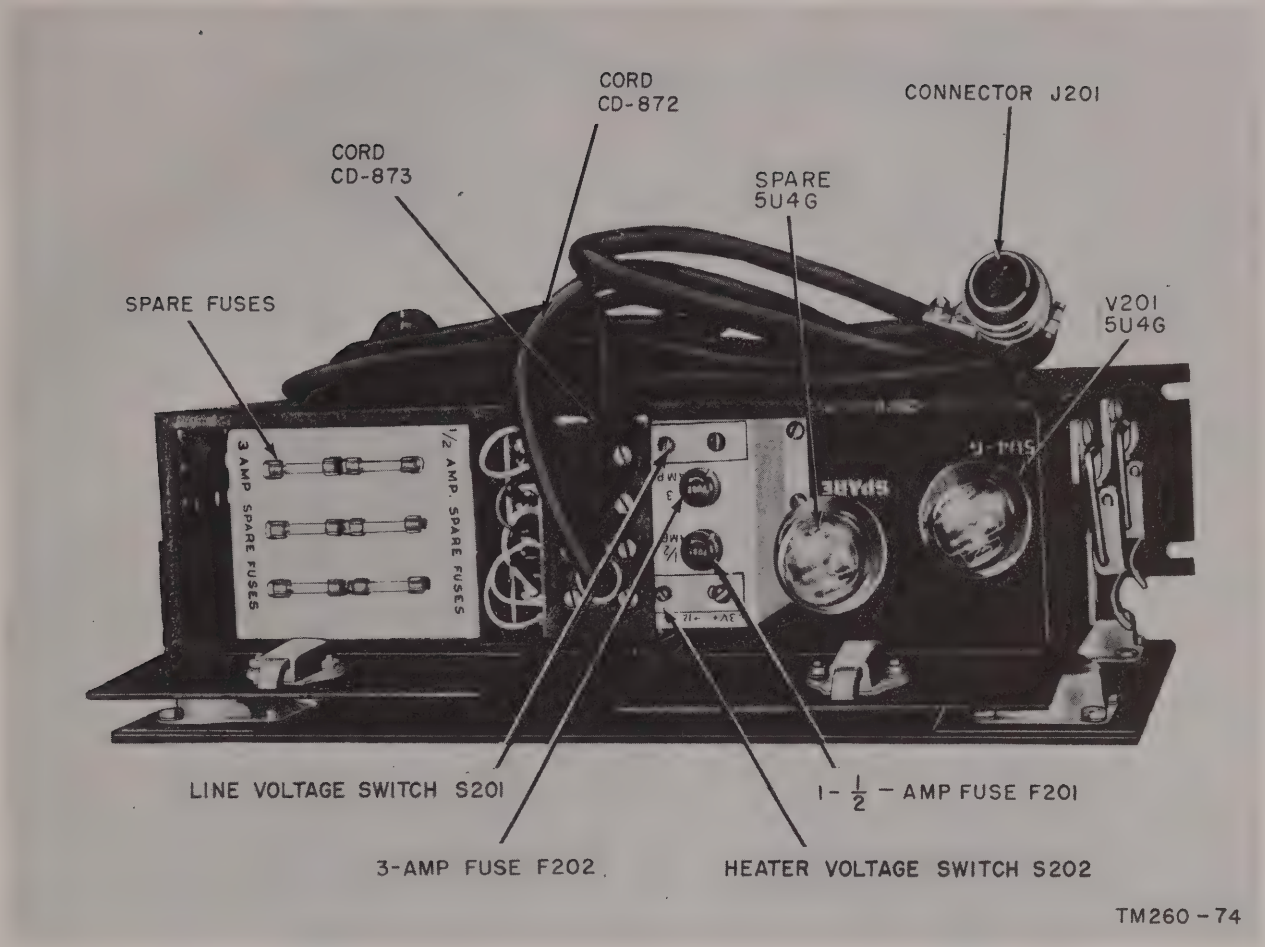


Figure 10. Power Supply Unit RA–61–A, rear view with doors open.

b. The power supply may be removed from its case and the panel-chassis assembly mounted in a standard relay rack. When the receiver and power supply are both rack mounted, locate the power supply so that it is convenient to the receiver and to the ac power source.

20. Connections

(figs. 10–12)

a. Radio Receiver BC–1269 Connections. When the receiver and power supply have been located in the position of operation and Antenna Equipment RC–281 has been erected, use the following procedure for interconnecting components.

(1) Remove the receiver from Case CS–138 and inspect the audio impedance-matching terminal board marked 250–4,000, on the underside of the chassis to determine that the tap is set to match the impedance of the headset in use. For operation with Headset HS–30–(*), the tap should be at 4,000. Replace the case and tighten the thumbscrews. A reversible plate between the two headset jacks on the front panel is marked PHONES 250 OHMS on one side and PHONES 4000 OHMS on the other side. The plate should be changed to correspond to the setting on the terminal strip.

(2) At the rear of the receiver are four sockets, a switch, and an output terminal board (fig. 12). Connect Cord CD–927, leading from Antenna AN–170 (the larger biconical), to the socket marked ANT 145–300. Connect the other Cord CD–927, leading from Antenna AN–169 (the smaller biconical), to the socket marked ANT 300–600.

(3) Set the AUDIO switch to HIGH. If it is desired to connect the receiver to a remote line, connect the line to the output

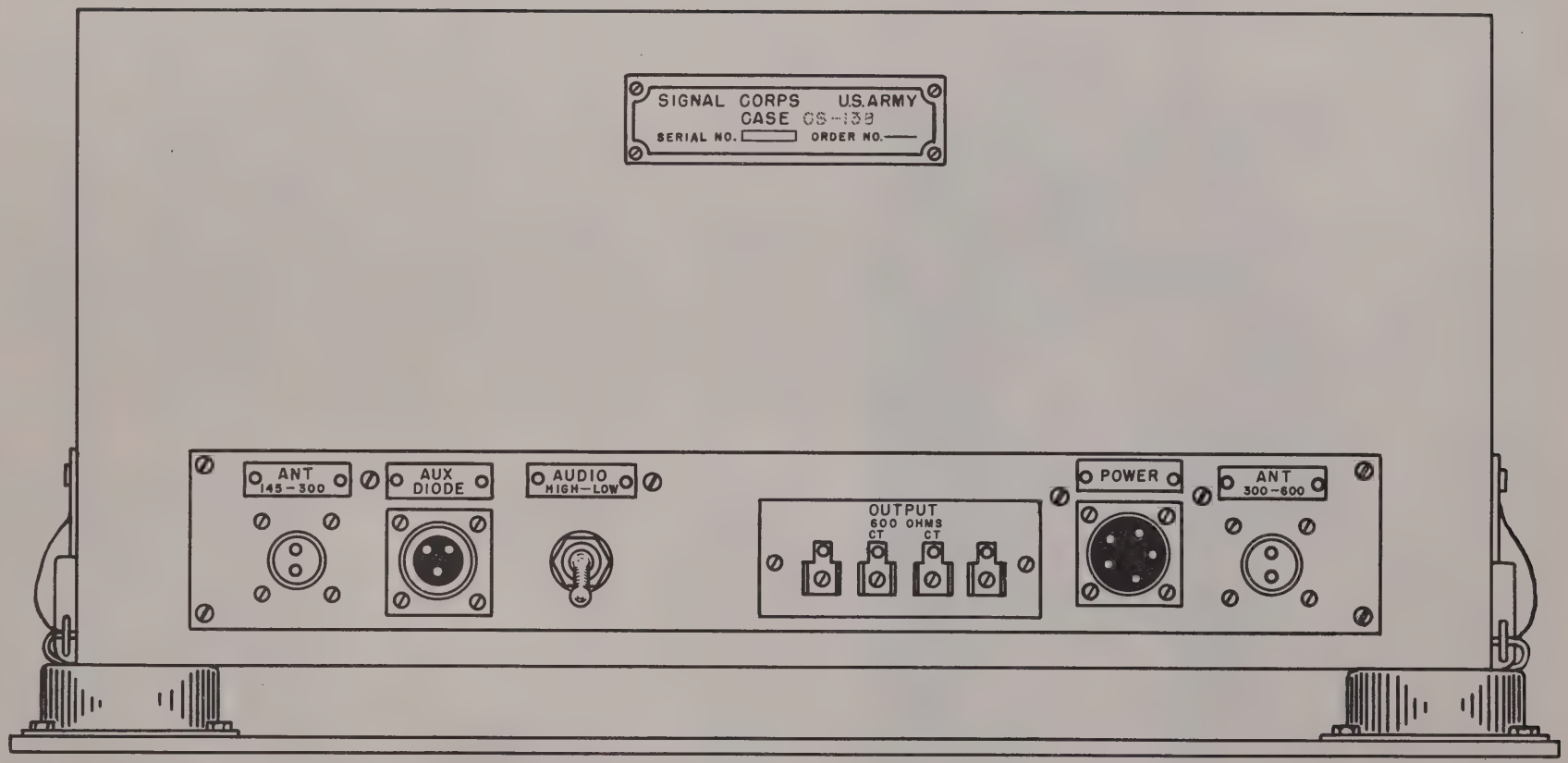


Figure 11. Radio Recei ers R-593G/RR and BC-1269-A, rear view.

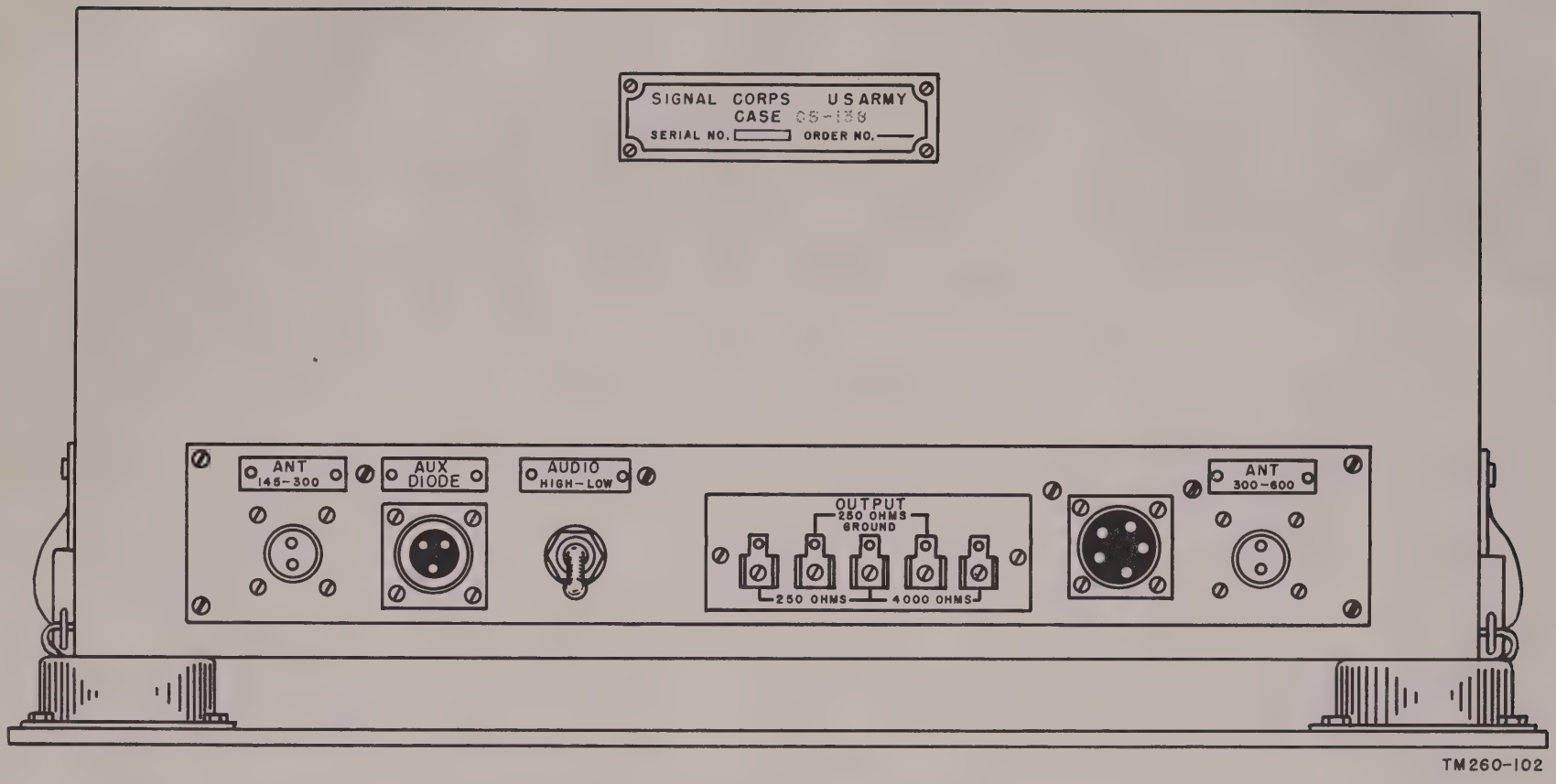


Figure 12. Radio Receiver BC–1269, rear view.

terminals which most nearly match the impedance to the remote line.

Note. The center terminal of the terminal board is grounded to the case. Thus, for a 250-ohm or 4,000-ohm load (end terminal to center), one side of the line is grounded. The second and fourth terminals are for connection of a 250-ohm load, balanced to ground.

(4) Plug Cord CD–872 from Power Supply Unit RA–61–A into the large male socket next to the terminal board on the rear of the receiver.

(5) Be sure that the POWER switch is set to OFF. Open the right-hand door of Power Supply Unit RA–61–A, as viewed from the rear, and inspect the two 5U4G rectifier tubes to see that they are fully inserted in their sockets (fig. 10). (Only one tube functions as the rectifier; the second one is a spare.)

(6) Determine that the line-voltage switch marked 115V–230V is set to the correct position for the supply voltage available. Be sure the heater voltage switch is in the 12.6V position. Inspect the fuses to see that they are rated properly, are seated firmly, and are not broken or burned out.

(7) Open the left-hand door and inspect the spare fuses to see whether a sufficient quantity of fuses of the proper rating is avialable.

(8) Close the two doors and connect Cord CD–873 to the power source. This completes the interconnection of Radio Set SCR–616 using Radio Receiver BC–1269.

b. Radio Receiver BC–1269–A and R–593/GRR Connections. When the receiver and power supply have been located in the operating position, and Antenna Equipment RC–281 has been erected, use the following procedure for interconnecting the components:

(1) Connect Cord CD–927, leading from Antenna AN–170 (the larger biconical), to the socket marked ANT 145–300 on the rear of the receiver (fig. 11). Connect the other Cord CD–927, leading from Antenna AN–169 (the smaller biconical), to the socket marked ANT 300–600.

(2) Set the AUDIO switch to HIGH.

(3) To connect the receiver to a 600-ohm remote line, connect a jumper wire between the two terminals marked CT on the OUTPUT terminal board and connect the line to the two remaining terminals. The PHONES jacks require a 600-ohm load.

(4) Plug Cord CD–872, from Power Supply Unit RA–61–A, into the POWER input socket next to the output terminal board.

(5) Be sure that the POWER switch on the front of the receiver is in the OFF position. Open the right-hand door of Power Supply Unit RA–61–A, as viewed from the rear, and inspect the two 5U4G rectifier tubes to see that they are firmly seated in their sockets. (Only one tube functions as the rectifier; the second one is a spare.)

(6) Determine that the line-voltage switch marked 115V–230V is set to the correct position for the supply voltage available. Be sure the heater voltage switch is in the 6.3V position. Inspect the fuses to see that they are rated properly, are seated firmly, and are not broken or burned out.

(7) Open the left-hand door and inspect the spare fuses to see that enough fuses of the proper rating are available.

(8) Close the two doors and connect Cord CD–873 to the power source. This completes the interconnection of Radio Set SCR–616 using Radio Receiver BC–1269–A or Radio Receiver R–593/GRR.

21. Service Upon Receipt of Used or Reconditioned Equipment

a. Follow the instructions given in paragraph 16 for uncrating, unpacking, and checking the equipment.

b. Check the used or reconditioned equipment for tags or other indications pertaining to changes in the wiring of the equipment. If any changes in wiring have been made, note the changes in this manual, preferably on the schematic diagram.

c. Check the operating controls for ease of rotation. If lubrication is required, refer to the lubrication instructions (par. 40).

d. Perform the installation and connection procedures given in paragraphs 17 through 20.

22. General

Improper setting of the filament and line voltage controls on the power supply can cause damage to this equipment. See paragraphs 8*e* and 10*b* for the correct operation of these controls. The actual operation of the equipment is discussed in the next section of this manual.

23. Controls and Their Uses

The following chart lists the controls of the receiver and their functions. A front panel view of a typical receiver is shown in figure 13.

Control	Function
FREQUENCY BAND switch (S1).	Selects the desired band of operation. Two clearly marked, detented positions are provided on the panel. The frequency of the operating band is registered on the dial scale visible through the dial window.
TUNING control	Selects the desired frequency channel. The frequency appears under the indicator hairline on the dial scale, which is calibrated in megacycles.
TUNING LOCK	When turned in a clockwise direction, locks the TUNING control in place after the operating frequency has been selected. The TUNING control is released by turning the TUNING LOCK in a counterclockwise direction.
MVC–AVC–FM switch (S4).	Selects the desired type of receiver operation. One of the three following operating conditions may be selected. (1) MVC: manual volume control for am and cw reception. (2) AVC: automatic volume control for am reception. (3) FM: frequency modulation.
BEAT-NOTE BALANCE control (R44) and OFF switch (S3).	Permits reception of cw signals. Used to turn the 1000-cycle tone on and off and to balance out the 1,000-cycle tone heard in the phones when no signal is being received. ***Caution:*** The BEAT-NOTE BALANCE control must be in the OFF position when the MVC–AVC–FM switch is in the AVC or FM position.
SENSITIVITY control (R27).	Provides manual sensitivity control. Normally, the control should be in the extreme clockwise position whenever the MVC–AVC–FM switch is in the AVC or FM position.
TONE control (R71)	Governs af tone. When the control is turned clockwise, the tone becomes higher, when it is turned counterclockwise, the tone becomes lower. This control also enables the operator to decrease the effects of certain types of interference.
VOLUME control (R72)	Controls the receiver audio output.
POWER switch (S2)	Turns on power supply which furnishes power for the receiver.
PHONES 600 OHMS (Radio Receivers BC–1269–A and R–593/GRR).	These jacks permit connection of two headsets for monitoring the audio output of the receiver.
PHONES 250 OHMS and PHONES 4000 OHMS jacks (Radio Receiver BC–1269).	These jacks permit connection of two head-sets for monitoring the audio output of the receiver. The output impedance of the two jacks, marked PHONES, may be adjusted for 250 or 4,000 ohms by moving the lead on the screw-type terminal strip to the desired impedance (par. 20*a*).
AUDIO switch (S5)	This switch is located on the rear apron of the receiver (fig. 11). When the switch is in the HIGH position, maximum audio power is available at the output terminals and headset jacks. With the switch in the LOW position, the audio power is considerably reduced.

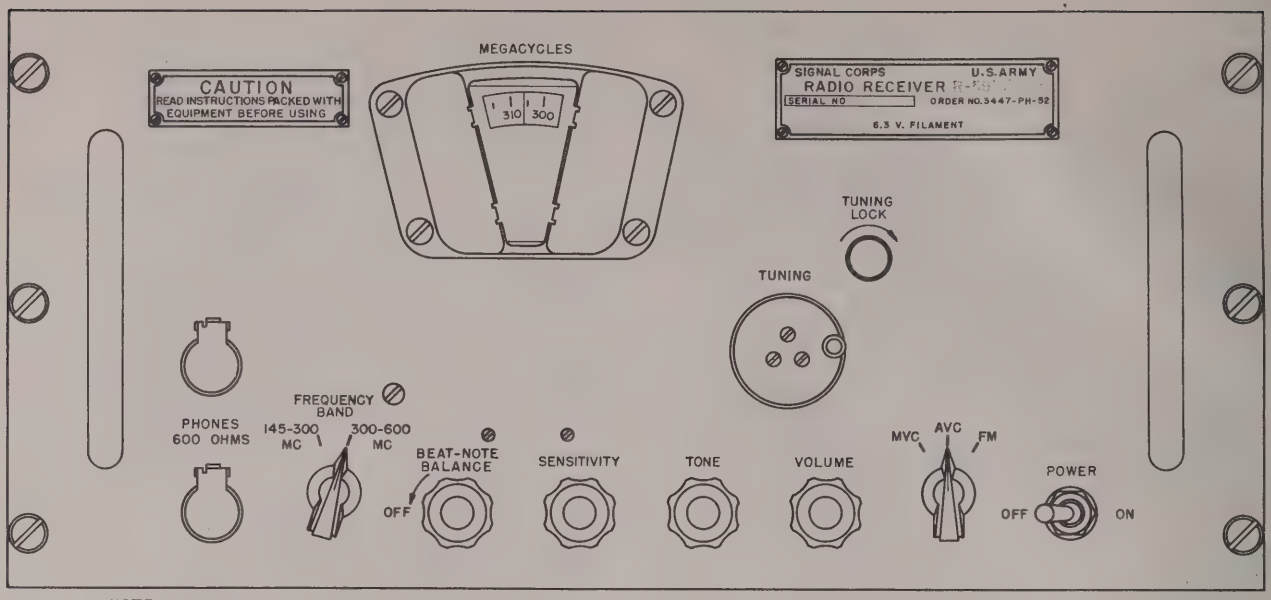


Figure 13. Receiver front panel.

Section III. OPERATION UNDER USUAL CONDITIONS

24. Starting Procedure

a. Preliminary. Set the receiver controls as follows:

Control	*Position*
AUDIO	HIGH.
FREQUENCY BAND	Desired range.
MVC–AVC–FM	Desired type of operation.
TONE	Fully counterclockwise.
BEAT-NOTE BALANCE	Switch to OFF.
SENSITIVITY	Fully clockwise.
VOLUME	Approximately midposition.

Caution: Before applying power to the radio set, be sure that switch S201 in Power Supply Unit RA–61–A is set to the proper line-voltage position. Also, be sure that switch S202 is set to provide the correct filament voltage for the receiver in use (par. 10).

b. Starting. Turn on the receiver by placing the POWER switch to the ON position. Turn the TUNING knob until the dial is set to approximately the desired frequency; then turn the knob slowly back and forth until the signal is picked up. Careful adjustment of the SENSITIVITY and VOLUME controls will aid in receiving weak signals.

25. Types of Reception

a. Am Signals.

(1) Am signals (radiophone and modulated cw) are best received with the MVC–AVC–FM switch in the AVC position. Refer to paragraph 24 for preliminary starting instructions.

(2) Set the MVC–AVC–FM switch to the AVC position.

(3) Advance the SENSITIVITY control fully clockwise and adjust the VOLUME control for audible background noise in the headset.

(4) Rotate the TUNING knob and tune in a desired signal.

(5) If overloading on strong signals occurs, set the VOLUME control to approximately midposition, and adjust the output level with the SENSITIVITY control.

(6) Adjust the TONE control as required to improve reception by minimizing the background noise.

b. Fm Signals.

(1) Set the MVC–AVC–FM switch in the

FM position. Refer to paragraph 24 for preliminary starting instructions.

(2) Advance the SENSITIVITY control fully clockwise and adjust the VOLUME control for audible background noise in the headset.

(3) Rotate the TUNING knob and tune in a desired signal.

(4) On strong signals, it may be necessary to set the VOLUME control to approximately midposition and control the output level with the SENSITIVITY control.

(5) Adjust the TONE control as required to suit the operators preference.

c. Cw Signals.

(1) For reception of cw signals, manual volume control (mvc) operation is required. Avc operation is not suitable because the gain of the receiver is allowed to fluctuate between successive dots and dashes. Refer to paragraph 24 for preliminary starting instructions.

(2) Set the MVC–AVC–FM switch to the MVC position.

(3) Advance both the SENSITIVITY and VOLUME controls for audible background noise in the headset.

(4) Rotate the BEAT-NOTE BALANCE control clockwise from the OFF position. A 1,000-cycle tone will be heard in the background noise. Adjust the BEAT-NOTE BALANCE control until the 1,000-cycle tone is a minimum.

(5) Rotate the TUNING knob and tune in the desired cw signal. The signal will be modulated with a 1,000-cycle tone.

(6) Readjust the SENSITIVITY and VOLUME controls for a clear signal.

26. Stopping Procedure

To turn off the radio set, set the POWER switch on the receiver to the OFF position.

27. Single Antenna Operation

a. The wide band characteristics of the biconical antennas in Antenna Equipment RC–281 permit operation of the receiver over a greater frequency range than is normally required. This feature may be used to advantage in the event of a defect in Antenna AN–170 or in one of the transmission lines. Antenna AN–169 may be used over the entire range of the receiver without a great reduction in the performance of the radio set. In addition, Mast Section MS–123 is insulated from ground and is provided with a terminal plate so that in an emergency, the supporting mast may be used as a vertical antenna whose output is coupled through a transmission line to the input of the receiver. Under these conditions, the necessity for a balanced transmission line is eliminated, and ordinary coaxial cable may be used. Use of Antenna AN–170 for operation on both bands is not recommended because of the undesirable field pattern that results when used on the high band.

b. The procedure discussed in *a* above is for emergency use only. Operation on a single antenna over the entire range of the receiver does not permit the radio set to operate at peak sensitivity and efficiency. Repair or replace the defective antenna components as soon as possible.

28. Antijamming

When the receiver is being jammed by unwanted signals, the immediate superior officer should be notified promptly. To obtain best read-through, carry out the operating procedures in the order indicated below for each type of operation.

a. Am Signals Jammed by Cw, Modulated Cw, Pulse, Fm Bagpipes, Noise, or Any Other Kind of Jamming.

(1) Slowly turn the TUNING control knob through several degrees first to one side then to the other side of the desired signal. Some separation of the desired signal from the jamming signal may be obtained.

(2) Switch the MVC–AVC–FM switch to the MVC position.

(3) If the desired signal is stronger by even a small amount, turn the SENSITIVITY control counterclockwise. This will decrease the receiver sensitivity and may eliminate the weaker jamming signal.

(4) If the desired signal is weaker than the jamming signal, turn the SENSITIVITY control to the extreme clockwise position. This will, if both signals are sufficiently strong, limit the jamming signal level to to that of the desired signal. Further improvement may be obtained by adjustment of the TONE control as indicated in (5) below.

(5) Adjust the TONE control to the position where the desired signal is more distinct. If the jamming signal contains a pre-

dominance of frequencies higher than the desired signal, counterclockwise rotation of the TONE control will make the desired signal more readable. If the jamming signal contains a predominance of frequencies lower than the desired signal, clockwise rotation of the control will make the desired signal slightly more readable.

(6) Turn up the VOLUME control. If the jamming signal is strong, this may improve the read-through.

(7) If none of the above steps provide read-through of the desired signal, make adjustments of the antenna system in the order given below, until best read-through is obtained.

(8) Reorient the antenna to obtain best readability.

(9) Vary the height of the antenna and try it at various angles from the horizontal to the vertical and back again. One or more of the adjustments will usually increase read-through.

(10) Place some object such as screen, tank, jeep, or truck between the antenna and the jamming source or relocate the antenna so that a barrier such as a tree, hill, metal structure, or similar obstacle is in the path of the jamming signal. The strength of the jamming signal may be decreased and permit copy of the desired signal.

(11) If none of the above provides satisfactory read-through, change to cw operations and follow the instructions for that type of operation.

b. Cw Signals Jammed by Any Type of Signals.

(1) Slowly turn the TUNING control knob through several degrees first to one side then the other side of the desired signal. Some separation of the desired signal from the jamming signal may be obtained.

(2) Switch the MVC–AVC–FM switch to the MVC position, which permits the sensitivity of the receiver to be adjusted manually by the SENSITIVITY control.

(3) If the desired signal is stronger, even by a small amount, turn the SENSITIVITY control counterclockwise. This will decrease the receiver sensitivity and may eliminate the weaker jamming signal.

(4) If the desired signal is weaker than the jamming signal, turn the SENSITIVITY control to the extreme clockwise position. This will, if both signals are sufficiently strong, reduce the jamming signal level to that of the desired signal. Further improvement may be obtained by adjustment of the TONE control as indicated in (6) below.

(5) Adjust the BEAT-NOTE BALANCE control and the SENSITIVITY control in conjunction with each other until the jamming signal is reduced to its lowest level. If the jamming signal is weaker than the desired signal, the SENSITIVITY adjustment can be set to cancel out the jamming signal, yet permit the stronger desired signal to come through.

(6) Adjust the TONE control until the 1,000-cycle note of the desired signal is most readable. Turning the TONE control counterclockwise will reduce any frequencies caused by the jamming signal that are above the 1,000-cycle desired signal.

(7) If none of the above steps provides read-through of the desired signal, make adjustments of the antenna system in the order indicated below until best read-through is obtained.

(8) Reorient the antenna to obtain best readability.

(9) Vary the height of the antenna and set it at various angles from the horizontal to the vertical and back again. One or more of the adjustments will usually increase the read-through.

c. Fm Signals Jammed by Any Type of Signals.

(1) Slowly turn the TUNING control knob through several degrees first to one side then the other side of the desired signal. Some separation of the desired signal from the jamming signal may be obtained.

(2) Adjust the TONE control to the position where the desired signal is more distinct. If the jamming signal contains a predominance of frequencies higher than the desired signal, turn the TONE control counterclockwise to make the desired signal more readable. If the jamming signal contains a predominance of frequencies lower than the desired signal,

turn the control clockwise to make the desired signal slightly more readable.

(3) Adjust the SENSITIVITY control until best read-through is obtained.

(4) Turn up the VOLUME control. If the jamming signal is strong, this may improve the read-through.

(5) If none of the above steps provide read-through, make adjustments of the antenna system.

(6) Reorient the antenna to obtain best readability.

(7) Vary the height of the antenna and try it at various angles from the horizontal to the vertical and back again. One or more of the adjustments will usually increase read-through.

(8) Place some object such as a screen, tank, jeep, or truck between the antenna and the jamming source or relocate the antenna so that a barrier such as a tree, hill, metal structure, or similar obstacle is in the path of the jamming signal. The strength of the jamming signal may be decreased and permit copy of the desired signal.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

29. General

The operation of Radio Set SCR–616 may be difficult in regions where extreme cold, heat, humidity and moisture, sand conditions, etc., prevail. In paragraphs 30 through 32, instructions are given on procedures for minimizing the effect of these unusual operating conditions.

30. Operation in Arctic Climates

Subzero temperatures and climatic conditions associated with cold weather affect the efficient operation of the equipment. Instructions and precautions for operation under such adverse conditions follow:

a. Handle the equipment carefully.

b. Keep the equipment warm and dry.

c. When conditions allow it, permit the receiver to operate continuously.

d. When equipment which has been exposed to the cold is brought into a warm room, it will sweat until it reaches room temperature. This condition also arises when equipment warms up during the day after exposure during a cold night. When the equipment has reached room temperature, dry it thoroughly.

31. Operation in Tropical Climates

When operated in tropical climates, radio equipment may be installed in tents, huts, or, when necessary, in underground dugouts. When equipment is installed below ground and when it is set up in swampy areas, moisture conditions are more acute than normal in the tropics. Ventilation is usually very poor, and high relative humidity causes condensation on the equipment whenever the temperature of the equipment becomes lower than the surrounding air.

32. Operation in Desert Climates

a. The main problem which arises with equipment operation in desert areas is the large amount of sand or dust and dirt which enters the moving parts of the equipment, such as gears and switches. The ideal preventive precaution is to house the equipment in a dustproof shelter. Since, however, such a building is seldom available and would require air conditioning, the next best precaution is to make the building in which the equipment is located as dustproof as possible with available materials.

b. Never tie power cords, signal cords, or other wiring connections to either the inside or the outside of tents. Desert areas are subject to sudden wind squalls which may jerk the connections loose or break the lines.

c. Keep the equipment as free from dust as possible. Make frequent preventive maintenance checks (par. 39). Pay particular attention to the condition of the lubrication of the equipment. Excessive amounts of dust, sand, or dirt that come into contact with grease result in grit, which will damage the equipment.

CHAPTER 3

ORGANIZATIONAL MAINTENANCE

Section I. TOOLS AND EQUIPMENT

33. General

The tools, parts, supplies, and test equipment necessary to perform organizational maintenance are authorized by appropriate publications. Additional tools are supplied with the radio set (par. 35).

34. Tools, Test Equipment, and Materials Required

The following tool, materials, and test equipment are not furnished as part of the radio set. They are required for organizational maintenance. Refer to paragraph 35 for special tools supplied.

a. Tool.

1 Tool Equipment TE–41

b. Test Equipment.

1 Multimeter TS–297/U

1 Electron Tube Test Set TV–7/U

c. Materials.

Orange stick

Cheesecloth, bleached, lint-free [a]

Sandpaper No. 000 [a]

Cleaning Compound (Federal stock No. 7930–395–9542)

35. Special Tools Issued with Radio Set SCR–616

a. Two special tools, an alinement tool and an Allen wrench are supplied with Radio Receiver R–593/GRR. These tools are located in clips attached to the rear of the front panel (fig. 39). The only tool supplied with Radio Receivers BC–1269–A and BC–1269 is an Allen wrench.

b. The Allen wrench is used for making adjustments on coupling shafts and for tightening knobs. The alinement tool is used to make adjustments in the rf and intermediate-frequency (if.) tuning sections of the receiver.

Section II. PREVENTIVE MAINTENANCE SERVICES

36. Definition of Preventive Maintenance

Preventive maintenance is work performed on equipment (usually when the equipment is not in use) to keep it in good working order so that breakdowns and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from troubleshooting and repair since its object is to prevent certain troubles from occurring.

37. General Preventive Maintenance Techniques

a. Use No. 000 sandpaper to remove corrosion.

b. Use a clean, dry, lint-free cloth or a dry brush for cleaning all parts (including electrical contacts). If necessary, moisten a cloth or brush with Cleaning Compound; then wipe the parts dry with a clean cloth.

Warning: Prolonged breathing of cleaning compound fumes is dangerous. Make sure adequate ventilation is provided. Cleaning compound is flammable; do not use near a flame.

c. For further information on preventive maintenance techniques, refer to TB SIG 178, Preventive Maintenance Guide for Radio Communications Equipment.

38. Use of Preventive Maintenance Forms

The decision concerning the items on DA Forms 11–238 and 11–239 that are to be applied to this equipment is to be made in the case of first echelon maintenance by the communication officer/chief or his designated representative, and in the case of second and third echelon maintenance, by the individual making the inspection. Instructions for the use of each form appear on the reverse side of the form. Items on figures 14 and 15 that are not struck out are partially or totally applicable to Radio Set SCR–616. References in the ITEM column refer to paragraphs that contain additional maintenance information.

[a] Part of Tool Equipment TE–41.

OPERATOR FIRST ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE	EQUIPMENT SERIAL NO.
Radio Set SCR-616	

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; (X) Defect corrected.
NOTE: Strike out items not applicable.

DAILY

NO.	ITEM	CONDITION S	M	T	W	T	F	S
1	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT (*receiver, ~~transmitter~~, carrying cases, wire and cable, ~~microphones~~, tubes, spare parts, technical manuals and accessories*). PAR. 39a(1)							
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION. PAR. 39a(2)							
3	CLEAN DIRT AND MOISTURE FROM ANTENNA, ~~MICROPHONE~~, HEADSETS, ~~CHESTSETS, KEYS~~, JACKS, PLUGS, ~~TELEPHONES, CARRYING BAGS~~, COMPONENT PANELS. PAR. 39a(3)							
4	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: ~~TUBES~~, LAMPS, ~~CRYSTALS~~, FUSES, CONNECTORS. ~~VIBRATORS, PLUG-IN COILS AND RESISTORS.~~ PAR. 39a(4)							
5	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. PAR. 39a(5)							
6	CHECK FOR NORMAL OPERATION. PAR. 39a(6)							

WEEKLY

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
7	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, ~~WAVE GUIDES~~, AND CABLE CONNECTIONS. PAR. 39a(7)		13	~~INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.~~	
8	INSPECT CASES, MOUNTINGS, ANTENNAS, ~~TOWERS~~, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. PAR. 39a(3)		14	~~CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES.~~	
9	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR. 39a(7)		15	~~INSPECT METERS FOR DAMAGED GLASS AND CASES.~~	
10	INSPECT ANTENNA FOR ~~ECCENTRICITIES~~, CORROSION, LOOSE FIT, DAMAGED INSULATORS. ~~AND REFLECTORS.~~ PAR. 39a (3) AND (9)		16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING. PAR. 39a(2)	
11	INSPECT ~~CANVAS ITEMS, LEATHER, AND~~ CABLING FOR MILDEW, TEARS, AND FRAYING. PAR. 39a(7)		17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION. PAR. 39a(9)	
12	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, ~~POWER STATS, RELAYS, SELSYNS, MOTORS, BLOWERS~~, CAPACITORS, ~~GENERATORS~~, AND PILOT LIGHT ASSEMBLIES. PAR. 39a(5)		18	~~CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.~~	

19 IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

DA FORM 1 MAY 51 11-238 REPLACES DA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

TM260-108

Figure 14. DA Form 11–238.

SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE: Radio Set SCR-616

EQUIPMENT SERIAL NO.:

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; (X) Defect corrected.
NOTE: Strike out items not applicable.

NO.	ITEM	CONDITION
1	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT (*receiver, ~~transmitter~~, carrying cases, wire and cable, ~~microphones, tubes~~, spare parts, technical manuals and accessories*). PAR. 39 a (1)	
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION. PAR. 39 a (2)	
3	CLEAN DIRT AND MOISTURE FROM ANTENNA, ~~MICROPHONE~~, HEADSETS, ~~CHESTSETS, KEYS~~, JACKS, PLUGS, ~~TELEPHONES, CARRYING BAGS~~, COMPONENT PANELS. PAR. 39 a (3)	
4	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: ~~TUBES~~, LAMPS, ~~CRYSTALS~~, FUSES, CONNECTORS, ~~VIBRATORS~~, PLUG-IN COILS AND RESISTORS. PAR. 39 a (4)	
5	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. PAR. 39 a (5)	
6	CHECK FOR NORMAL OPERATION. PAR. 39 a (6)	
7	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, ~~WAVE GUIDES~~, AND CABLE CONNECTIONS. PAR. 39 a (7)	
8	INSPECT CASES, MOUNTINGS, ANTENNAS, ~~TOWERS~~, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. PAR. 39 a (3)	
9	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR. 39 a (7)	
10	INSPECT ANTENNA FOR ~~ECCENTRICITIES~~, CORROSION, LOOSE FIT, DAMAGED INSULATORS ~~AND REFLECTORS~~. PAR. 39 a (3) AND (9)	
11	INSPECT ~~CANVAS ITEMS, LEATHER, AND~~ CABLING FOR MILDEW, TEARS, AND FRAYING. PAR. 39 a (7)	
12	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, ~~POWERSTATS, RELAYS~~, SELSYNS, MOTORS, ~~BLOWERS~~, CAPACITORS, ~~GENERATORS~~, AND PILOT LIGHT ASSEMBLIES. PAR. 39 a (5)	
13	~~INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.~~	
14	~~CLEAN AIR FILTERS, DRAGG HAVE PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES.~~	
15	~~INSPECT METERS FOR DAMAGED GLASS AND CASES.~~	
16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING. PAR. 39 a (2)	
17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION. PAR. 39 a (9)	
18	~~CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.~~	
19	~~ELECTRON TUBES - INSPECT FOR LOOSE ENVELOPES, CAP CONNECTORS, CRACKED SOCKETS, INSUFFICIENT SOCKET SPRING TENSION; CLEAN DUST AND DIRT CAREFULLY; CHECK EMISSION OF RECEIVER-TYPE TUBES.~~	
20	~~INSPECT FILM CUT-OUTS FOR LOOSE PARTS, DIRT, MISALIGNMENT AND CORROSION.~~	
21	INSPECT FIXED CAPACITORS FOR LEAKS, BULGES, AND DISCOLORATION. PAR. 39 b (1)	
22	~~INSPECT RELAY AND CIRCUIT BREAKER ASSEMBLIES FOR LOOSE MOUNTINGS; BURNED, PITTED, CORRODED CONTACTS; MISALIGNMENT OF CONTACTS AND SPRINGS; INSUFFICIENT SPRING TENSION; BINDING OF PLUNGERS AND HINGE PARTS.~~	
23	INSPECT VARIABLE CAPACITORS FOR DIRT, MOISTURE, MISALIGNMENT OF PLATES, AND LOOSE MOUNTINGS. PAR. 39 b (2)	
24	INSPECT RESISTORS, BUSHINGS, AND INSULATORS, FOR CRACKS, CHIPPING, BLISTERING, DISCOLORATION AND MOISTURE. PAR. 39 b (3)	
25	INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR CORROSION, DIRT AND LOOSE CONTACTS. PAR. 39 b (4)	
26	CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, ~~BLOWERS, RELAY CASES, AND INTERIORS OF CHASSIS AND CABINETS~~ NOT READILY ACCESSIBLE. PAR. 39 b (5)	
27	INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS. PAR. 39 b (5)	
28	~~CHECK SETTINGS OF ADJUSTABLE RELAYS.~~	
29	LUBRICATE EQUIPMENT ~~IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF THE ARMY LUBRICATION ORDER~~. PAR. 39 b (6)	
30	~~INSPECT GENERATORS, AMPLIDYNES, DYNAMOTORS, FOR BRUSH WEAR, SPRING TENSION, ARCING, AND FITTING OF COMMUTATOR.~~	
31	CLEAN AND TIGHTEN CONNECTIONS AND MOUNTINGS FOR TRANSFORMERS, CHOKES, POTENTIOMETERS, ~~AND RHEOSTATS~~. PAR. 39 b (7)	
32	~~INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS FOR OVERHEATING AND OIL LEAKAGE.~~	
33	~~BEFORE SHIPPING OR STORING - REMOVE BATTERIES.~~	
34	~~INSPECT CATHODE RAY TUBES FOR BURNT SCREEN SPOTS.~~	
35	~~INSPECT BATTERIES FOR SHORTS AND DEAD CELLS.~~	
36	~~INSPECT FOR LEAKING WATERPROOF GASKETS, WORN OR LOOSE PARTS.~~	
37	MOISTURE AND FUNGIPROOF. PAR. 39 b (8)	
38	IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.	

DA FORM 1 MAY 51 11-239 REPLACES DA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE. e0—16—54382-1

TM 260-109

Figure 15. DA Form 11–239.

39. Performing Preventive Maintenance

a. Performing Exterior Preventive Maintenance.

Caution: Tighten screws, bolts, and nuts carefully. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.

(1) Check for completeness and satisfactory condition of the components of the radio set. The components of the radio set are listed in paragraph 7.

(2) Check installation for normal operation (par. 15).

(3) Keep exterior surfaces clean of moisture, lubricants, and dirt. Check Antennas AN–169 and AN–170 for clean insulated surfaces, inspect antenna sections for signs of surface corrosion, paint damage, dirt, and bent mast sections.

(4) Inspect seating of fuses, pilot lights, and cable connections. Refer to paragraph 20.

(5) Inspect panel controls on the receiver for binding, scraping, backlash, excessive looseness and positive action (par. 44).

(6) Check for normal operation (par. 46).

(7) Inspect cords, cables, and shock mounts for cuts, breaks, fraying, deterioration, and strain.

(8) Clean name plates and dial windows.

(9) Inspect antenna guy wires for looseness and proper tension. Inspect guy wire stakes and staying rod arm stakes for looseness (par. 17).

b. Performing Interior Preventive Maintenance.

Note. Interior preventive maintenance is not to be performed by operator.

(1) Inspect fixed capacitors C203, C204, and C205 for leaks, bulges, and discoloration (fig. 38).

(2) Inspect variable capacitors for dirt, moisture, misalinement of plates, and loose mountings (figs. 40 and 41).

(3) Inspect resistors, bushings, and insulators for cracks, blistering, discoloration, and moisture (figs. 37 and 42).

(4) Inspect terminals of fixed capacitors and resistors for corrosion, dirt, and loose contacts (figs. 37 and 42).

(5) Inspect terminal boards for loose connections, swelling, discoloration, cracks, or breaks.

(6) Lubricate the equipment in accordance with instructions in paragraph 40.

(7) Clean and tighten connections for transformer T201 and chokes L201 and L202 (fig. 38).

(8) Check adequacy of moistureproofing and fungiproofing.

Section III. LUBRICATION AND WEATHERPROOFING

40. Lubrication

a. General. Do not use excessive amounts of lubricant and do not allow connections to become greasy. See that the lubricant used and points to be lubricated are clean and free from sand, grit, or dirt. These abrasives are the chief causes of wear and are often the cause of frequent replacements. Use Cleaning Compound to clean dirty surfaces prior to lubrication. The only component of the radio set that requires lubrication is the receiver.

b. Lubrication of Receiver (fig. 16). The major assembly requiring lubrication in the receiver is the tuning and dial drive mechanism which is shown in two views in figure 16. The top view (A, fig. 16) shows the mechanical coupling points between the flexible couplings and the lf and hf band tuning shafts. The cutaway front view (B, fig. 16) shows the shutter arm assembly and the gear train with the TUNING and LOCK control shafts. Lubricate the following points with grease (GL) every 6 months or more often if operated under unusual climatic conditions:

(1) Gear train teeth.

(2) Shutter arm assembly.

(3) Flexible coupling assemblies.

41. Weatherproofing

a. General. Signal Corps equipment, when operated under severe climatic conditions such as prevail in tropical, arctic, and desert regions, requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials.

b. Tropical Maintenance. A special moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. This treatment is explained in TB SIG 13, Moistureproofing and

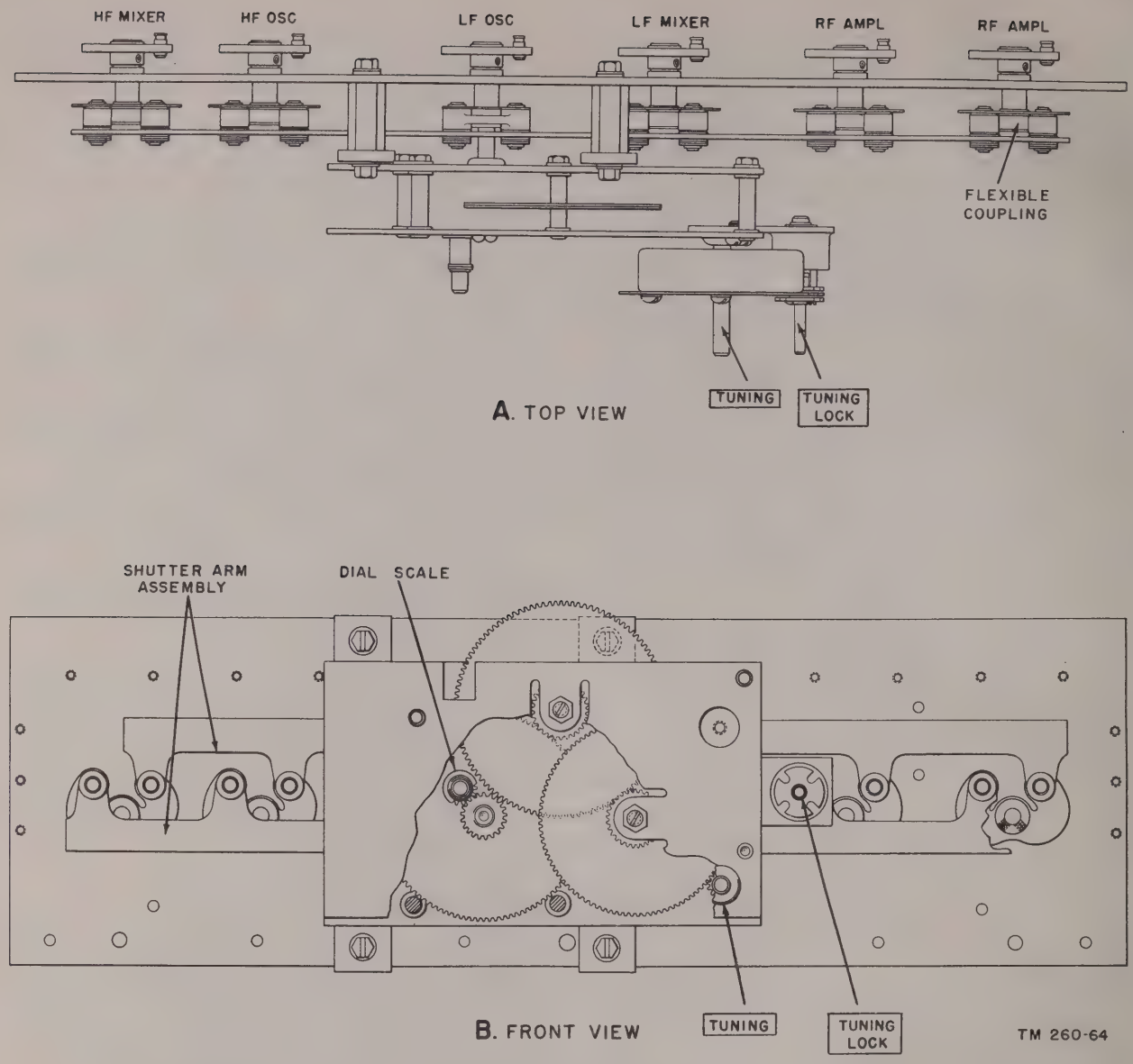


Figure 16. Receiver tuning and dial drive mechanism.

Fungiproofing Signal Corps Equipment, and TB SIG 72, Tropical Maintenance of Ground Signal Equipment. Most items of Signal Corps equipment are given this treatment at the factory. Therefore, it is necessary to repeat the treatment only when parts are replaced or repaired.

c. Arctic Maintenance. Special precautions necessary to prevent poor performance or total operational failure of equipment at extremely low temperatures are explained in TB SIG 66, Winter Maintenance of Signal Equipment, and in TB SIG 219, Operation of Signal Equipment at Low Temperatures.

d. Desert Maintenance. Special precautions necessary to prevent equipment failure in areas subject to extremely high temperatures, low humidity, and excessive sand and dust are explained in TB SIG 75, Desert Maintenance of Ground Signal Equipment.

e. Lubrication. The effects of extreme cold and heat on materials and lubricants are explained in TB SIG 69, Lubrication of Ground Signal Equipment. Observe all precautions outlined in TB SIG 69 and pay strict attention to all lubrication orders when operating equipment under conditions of extreme cold or heat. Refer to paragraph 40 for detailed lubrication instructions.

42. Rustproofing and Painting

a. When the finish on the case has been badly scarred or damaged, rust and corrosion can be prevented by touching up bared surfaces. Use No. 00 or No. 000 sandpaper to clean the surface down to the bare metal; obtain a bright smooth finish.

Caution: Do not use steel wool. Minute particles frequently enter the case and cause harmful internal shorting or grounding of circuits.

b. When a touchup job is necessary, apply paint with a small brush. Remove rust from the case by cleaning corroded metal with Cleaning Compound. In severe cases, it may be necessary to use Cleaning Compound to soften the rust and to use sandpaper to complete the preparation for painting. Paint used will be authorized and consistent with existing regulations. For further information on painting equipment refer to TM 9–2851, Painting Instructions for Field Use.

Section IV. TROUBLESHOOTING AT ORGANIZATIONAL MAINTENANCE LEVEL

43. Extent of Instructions

a. Troubleshooting at an organizational level is limited to the localizing of defective parts that are readily replaceable at an organizational level (tubes, fuses, cables, etc.), or to the sectionalizing of defective units that must be replaced as a unit (receiver-transmitter, power supply, control unit, etc). The procedures in *b* below are designed to determine first the defective unit and then the nature of the fault within the unit. If the fault cannot be determined through the procedures given in paragraphs 43 through 46, turn in the equipment for repair.

b. The techniques that are utilized for organizational troubleshooting include visual inspection, operational test, tube tests, and simple continuity checks. The material is presented in the order which the repairman would normally use in servicing a defective radio set.

44. Inspection and Sectionalization

a. When failure is encountered and the cause is not immediately apparent, check as many of the items listed in *b* and *c* below as is practicable before starting a systematic operational check of the equipment. Do not, however, disassemble the set for a complete inspection without some knowledge of the operational symptoms. If possible, obtain information from the operator of the equipment regarding performance at the time trouble occurred.

b. Complete failure of the radio set often may be caused by one or more of the following faults:

(1) Improperly connected power cable.
(2) Worn, broken, or disconnected cords or plugs.
(3) Blown fuses (fig. 38).
(4) Switches (or other controls) set wrong.

c. Partial failure of the radio set often may be caused by one or more of the following faults:

(1) Broken tubes.
(2) Defective tubes.
(3) Improperly oriented (or sited) antenna (par. 17).

d. System sectionalization consists of a process of elimination based upon visual, audible, or other observations which are made to determine whether the fault exists in a particular component, such as the receiver antenna, or power supply. To evaluate symptoms, see the equipment performance check list (par. 46) and troubleshooting chart in paragraph 76. Operate the radio set and observe its performance. If the entire radio set is dead, the trouble is probably at the power source, or power input connections. Check fuses F201 and F202 in the ac input circuit to Power Supply Unit RA–61–A (fig. 10). Check connections and wiring of source voltage circuits.

45. Electron Tube Replacement Procedure

Recent studies of maintenance practices have disclosed that more than one-third of all electron tubes are needlessly discarded as faulty. This waste of material must be reduced through effective supply economy measures and training of repair personnel. All personnel concerned will use the information given below as a guide.

a. Inspect all cabling, connections, and the general condition of the equipment before attempting removal of electron tubes.

b. Isolate the trouble, if possible, to a particular unit or section of the equipment.

c. If a tube tester is available, remove and test one tube at a time.

d. If a tube tester is not available, troubleshoot by the tube substitution method.

(1) Replace the suspected tubes, one at a time, with new tubes. Note the sockets from which the original tubes were removed. If the equipment becomes opera-

tive, discard the last tube removed. The lf. and hf. oscillator circuits, V5 and V2, may function with one tube and not another—even though both tubes are new. If practicable, retain any removed tube until its condition is checked by a suitable test instrument.

(2) Reinsert the remaining original tubes, one at a time, in the original sockets. If equipment failure occurs during this step, discard the last original tube. *DO NOT LEAVE A NEW TUBE IN A SOCKET IF THE EQUIPMENT OPERATES SATISFACTORILY WITH THE ORIGINAL TUBE.*

(3) If there is an insufficient number of spare tubes, try one of the following methods:

(*a*) Substitute a new tube for one original tube. If the equipment continues to be inoperative, replace the new tube with the original. Similarly, check each original tube in turn, until the equipment becomes operative.

(*b*) Often it is possible to remove a tube from one section of the equipment without affecting the section being checked. In this case, troubleshoot the defective section using this tube as a substitute spare.

(*c*) If a replacement for a bad tube soon becomes defective, check the adjustment and condition of component parts of the tube circuit. Otherwise, continued tube replacement will effect only temporary repair and more serious troubles may result.

e. If tube substitution does not correct the trouble, *reinsert the original tubes in the original sockets* before forwarding the defective equipment for higher echelon repair.

f. As a general rule, discard tubes when the following conditions are met:

(1) A test in a tube tester or other instrument shows that the tube is defective.

(2) The tube defect is obvious. For example, the glass envelope is broken, the filament is open, or a connecting prong or lead is broken.

g. Do not discard tubes merely because the tubes have been used for a specified length of time. Satisfactory operation in a circuit is the final proof of tube quality. The tube in use may work better than a new one.

h. Do not discard tubes merely because they fall *on or slightly below* the minimum acceptability value when checked in a tube tester. It must be recognized that a certain percentage of new tubes fall near the low end of the acceptability range of the tube specification and, therefore, start their operational life at a value fairly close to the tube tester *retention limit*. These tubes may provide satisfactory performance throughout a long period of operational life at this *near limit* value. Substitute new tubes only for those which are defective.

i. Use special care in withdrawing a miniature tube from its socket. *Do not rock* or rotate the top of a miniature tube when removing from socket—*pull straight out.* The external pin and the wire lead sealed in the glass base are two different metals which are butt-welded together where the pin appears to enter the glass. Rocking or rotating the tube causes bending which tends to break this weld or cause a resistance or intermittent joint to develop.

46. Troubleshooting by Using Equipment Performance Check List

a. Purpose and Use. The equipment performance check list is the beginning of a systematic troubleshooting technique designed to isolate trouble with a minimum of waste effort. Operate the equipment as directed in the check list, check for the normal indications listed and, if an abnormal indication is obtained, follow the corrective measure outlined in the final column of the check list.

b. Corrective Measures. In a few cases, the nature of the possible abnormal indications permits immediate localization of trouble to a particular part, so that the corrective measure indicates the specific part to be repaired or replaced. In most cases, however, the possible abnormal indications provide only for sectionalization of the trouble to a particular unit or group of parts. In these latter cases, the corrective measures call for the performance of additional testing procedures in order to localize the trouble. When the procedure referred to is beyond the scope of organizational maintenance personnel, reference is made to specific paragraphs in this manual and troubleshooting at a higher maintenance level is required.

c. Equipment Performance Check List.

	Item No.	Unit	Item	Action or condition	Normal indication	Corrective measures
PREPARATORY	1	Receiver	POWER switch	Set to OFF		
	2	Power supply	Line-voltage switch	Open the right-hand door and determine that the switch marked 115V–230V is set to the correct position for the supply voltage (par. 10).		
	3	Power supply	Fuses	Inspect fuses F201 and F202 to see that they are seated firmly and are not broken or burned out.		Replace defective fuses.
	4	Power supply	Cord CD–872	Plug Cord CD–872 into ac power source receptacle.		
	5	Receiver	AUDIO switch	Set at HIGH.		
	6	Receiver	Cords CD–927	Check the cord leading from Antenna AN–170 (larger biconical) to the socket marked ANT 145–300; and the cord leading from Antenna AN–169 to the socket marked ANT 300–600.		
	7	Receiver	Headset HS–30–(*) or Electrical Headset H–113/U.	Connect the headset to the PHONES jack.		
	8	Receiver	FREQUENCY BAND switch.	Turn first to 145–300 MC then to 300–600 MC.	*a.* Frequency of operating band registers on MEGACYCLES dial scale.	*a.* Check ball in detent which may have been jarred out. If necessary have a repairman replace ball (par. 84).
					b. Positive detent action.	*b.* Check shutter linkage for tightness (fig. 16).

	Item No.	Unit	Item	Action or condition	Normal indication	Corrective measures
START	9	Receiver	BEAT-NOTE BALANCE, VOLUME, SENSITIVITY, and TONE controls.	Set the controls to full clockwise position.	Controls turn smoothly and stop positively.	Tighten control knob set screws or shaft couplings.
	10	Receiver	POWER switch	Set to ON	Pilot lamps light and after a short interval background noise is heard in headset.	*a.* Check fuses F201 and F202 in power supply. *b.* Check pilot lamps. *c.* Check cable connections between power supply and receiver. *d.* Check connections from power supply to ac source. *e.* Check setting of line-voltage switch and heater voltage switch in power supply.
EQUIPMENT PERFORMANCE	11	Receiver	MVC–AVC–FM switch.	Set to MVC	Switch detents firmly and knob pointer indicates MVC position.	Position and retighten knob.
	12	Receiver	VOLUME control	Rotate control to adjust receiver output to a comfortable level.	Output increases with clockwise rotation; decreases with counterclockwise rotation.	Check VOLUME control R72 (par. 78).
	13	Receiver	BEAT-NOTE BALANCE control.	Rotate control	A tone modulation of the background noise will be heard in the headset. Rotate the control until the background 1,000-cycle tone is minimized.	Replace tube V13. Refer to paragraph 76.
	14	Receiver	TUNING LOCK	Loosen (turn counterclockwise).	See item 15.	
	15	Receiver	TUNING control	*a.* Rotate to the desired frequency channel.	*a.* TUNING control turns smoothly. Frequency appears under hairline indicator on the MEGACYCLES dial scale.	*a.* Check gear and reduction drives.
				b. Tune cw signal for maximum output.	*b.* The receiver cw signal will be modulated with 1000-cycle tone.	*b.* Check links that connect all variable capacitors for loose setscrews.
				c. Tighten TUNING LOCK (turn clockwise).		

	Item No.	Unit	Item	Action or condition	Normal indication	Corrective measures
EQUIPMENT PERFORMANCE	16	Receiver	SENSITIVITY control.	Adjust for comfortable sound level in headset.	Amplitude of received signal is reduced.	Replace tubes V7 and V8. Refer to paragraph 78.
	17	Receiver	TONE control	*a.* Turn counterclockwise. *b.* Turn clockwise	*a.* High frequencies are attenuated. *b.* High frequencies are restored.	*a.* Check TONE control R71. *b.* Refer to paragraph 78.
	18	Receiver	MVC–AVC–FM switch.	Turn to AVC position.	Noise level in receiver should be noticeably reduced.	See paragraph 78.
	19	Receiver	BEAT-NOTE BALANCE control.	Set to OFF	Tone modulation of signal and background noise will not be heard.	Check switch S3, part of BEAT-NOTE BALANCE control (R44). Refer to paragraph 76.
	20	Receiver	Controls	Set controls as in items 10, 12, and 14 through 17.		
	21	Receiver	MVC–AVC–FM switch.	Set to FM	Noise level is further reduced.	Replace V10, V11, V15. Refer to paragraph 76.
	22	Receiver	BEAT-NOTE BALANCE control.	Set to OFF	Tone modulation of signal and background noise will not be heard.	Check switch S3, part of BEAT-NOTE BALANCE control (R44). Refer to paragraph 76.
	23	Receiver	Controls	Set controls as in items 10, 12, and 14 through 17.	Fm signals and background noise will be heard.	
STOP	24	Receiver	POWER switch	Turn to OFF position.	Pilot lamps go out. Receiver and power supply unit are both turned off.	Check power plug J3. Check switch S2.

CHAPTER 4

THEORY

47. Block Diagram of Receiver
(fig. 17)

Radio Receivers R–593/GRR, BC–1269, and BC–1269–A are the superheterodyne type and are designed to receive am, fm, and cw signals over their frequency range of 145 to 600 mc. The frequency range is covered in two bands: the low-frequency band is from 145 to 300 mc, and the high-frequency band is from 300 to 600 mc. Except for the differences in tubes and the use of two tubes for the low-frequency rf amplifier in the BC–1269–A, the block diagram in figure 17 applies to all models of the receiver.

a. Each of the two frequency bands has an independent antenna, separate mixer, and oscillator stages. The low-frequency band section of the receiver includes an rf amplifier stage; no rf amplifier is used for the high-frequency section. When the receiver is set for low-frequency band operation, signals received on Antenna AN–170 are coupled to rf amplifier stage V3, or V18 and V19 in the case of the BC–1269–A. The output of V3 and the output of low-frequency oscillator V5 are combined in mixer stage V4. The desired output of V4 is then fed to the if amplifier stages through FREQUENCY BAND switch S1. When the receiver is set for high-frequency operation, signals received on Antenna AN–169 are coupled directly to mixer V1. The output of hf oscillator V2 is also fed to V1 and the desired output is coupled to the if amplifier stages through switch S1.

b. There are four stages of if. amplification: V6, V7, V8, and V9. For am reception, V10 acts as a detector whose output is fed to one section of V15 through a section of MVC–AVC–FM switch S4. For fm reception, V10 functions as a limiter whose output is coupled to discriminator stage V11 through another section of switch S4. The output of the discriminator is fed to the second section of V15. The MVC–AVC–FM switch controls the voltage to the two sections of V15 and selects either fm or am operation. The audio output from the active section of V15 passes through audio amplifiers V16 and V17 to the PHONES jacks and to an output terminal board (not shown) at the back of the receiver.

c. For reception of cw signals, an injection oscillator, V13, is used to inject a 1,000-cycle audio tone into the grid circuit of fourth if stage V9. With switch S3 (part of BEAT-NOTE BALANCE control) closed, all signals passing through V9 are modulated with the audio tone. After detection, the signal in the output circuit is similar to the output of a receiver using a beat-frequency oscillator, except that the pitch is constant at 1,000 cycles.

d. For direction finder applications, auxiliary diode V14 is used to energize a meter in proportion to the strength of an incoming signal. The circuit terminates in a connector at the rear of the receiver; the meter is connected externally and is not supplied as part of the equipment.

48. Antenna Equipment RC–281
(fig. 18)

The theory of operation for biconical antennas AN–169 and AN–170 is basically the same as the theory for a simple half-wave dipole antenna. Antenna AN–170, which is used for operation on the low-frequency band, operates as a half-wave antenna in the 145- to 300-mc range. Antenna AN–169, which is used for operation on the high-frequency band, operates as a half-wave antenna in the 300- to 600-mc range.

a. Antenna Patterns.

(1) The field intensity pattern for the simple dipole antenna in the horizontal plane is similar to a figure "8". Maximum response is at right angles to the plane of the antenna, with the result that a horizontally polarized dipole antenna provides maximum sensitivity in two directions: for signals arriving from in front of the antenna and for signals arriving from behind the antenna. Thus, a horizontal polarized dipole antenna exhibits bidirectional characteristics.

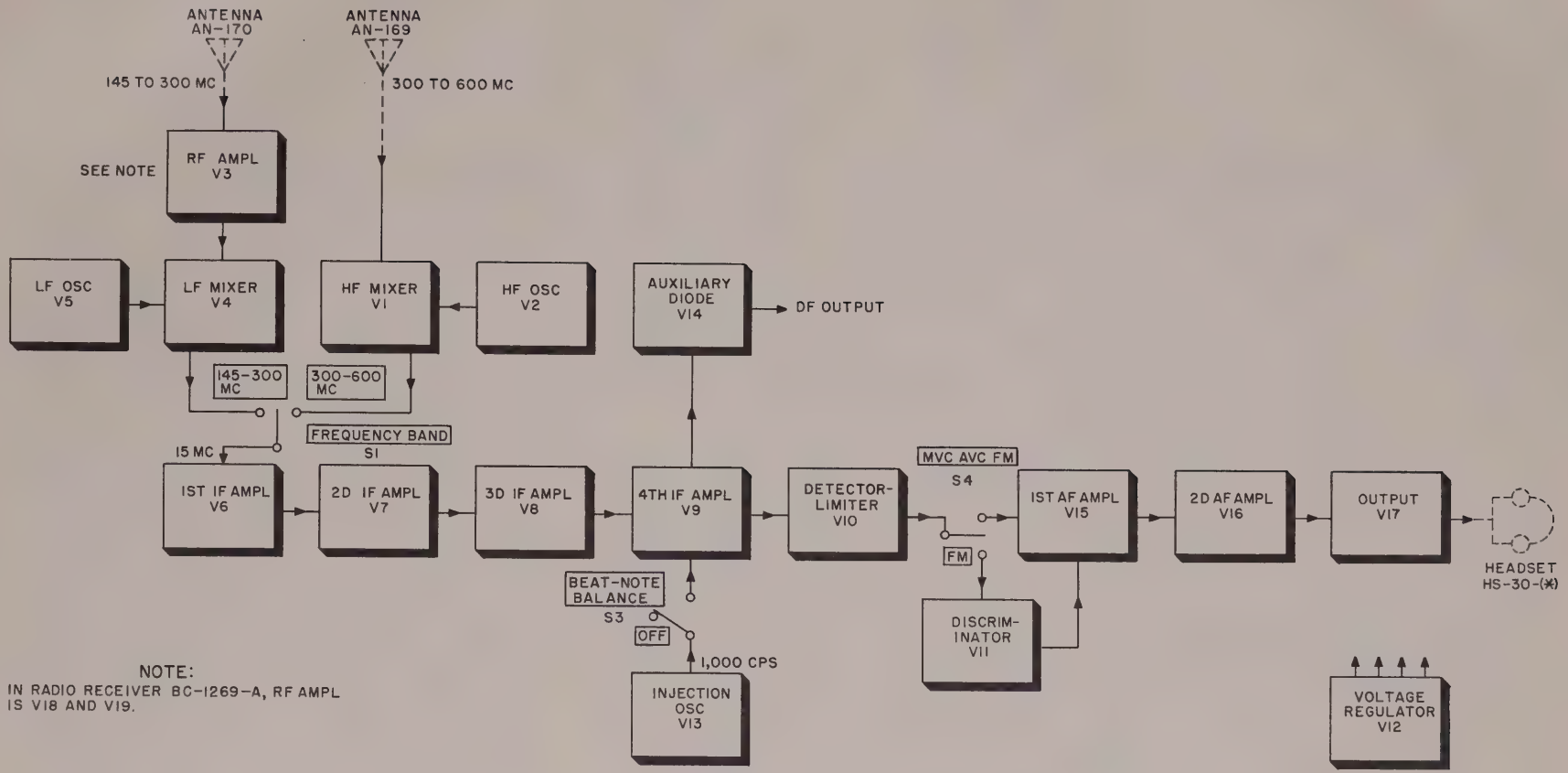


Figure 17. Block diagram of Radio Receivers R–593/GRR, BC–1269, and BC–1269–A.

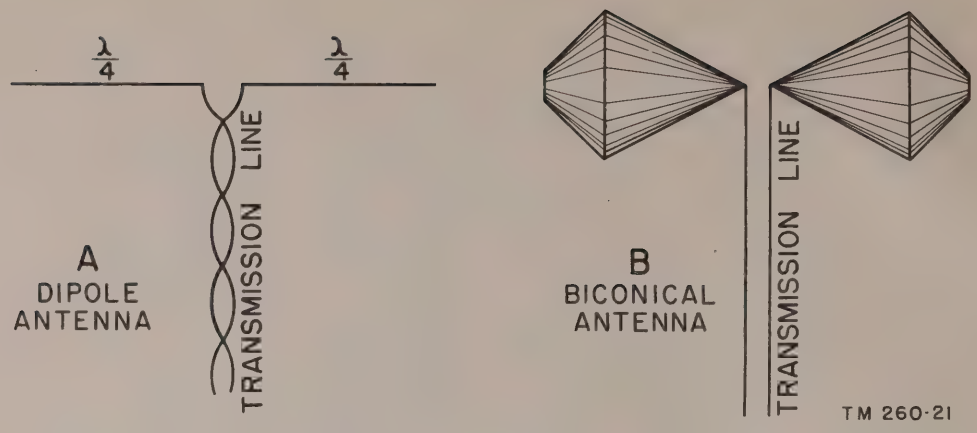


Figure 18. Comparison of dipole and biconical antennas.

(2) For a vertically polarized antenna, the field intensity pattern is also a figure "8." Since the response is maximum at right angles to the plane of the antenna, the sensitivity of a vertically polarized antenna is uniform for signals arriving in a horizontal direction. Thus, a vertically polarized antenna exhibits no directional characteristics.

b. Other Characteristics. The response of a dipole antenna is maximum when it is resonant. This condition occurs when the wave length of the incoming signal is approximately twice the length of the dipole. Other signal frequencies on either side of the resonant frequency produce reduced voltages in the dipole antenna. This is accompanied by a change in the characteristic impedance of the antenna which results in a mismatch and further reduces the voltage available at the receiver.

c. Biconical Construction. If two dipoles spaced at an angle are used for each half of the antenna, then the antenna exhibits certain differences from a half-wave antenna. Because of the greater cross sectional area the Q or ratio of inductance to capacitance is smaller and the input impedance becomes very high. The lower Q gives the antenna a broader frequency response. If the number of dipoles is increased to the point where the halves of the antenna become a cone consisting of a solid sheet, then the impedance is lowered. The apex angle of the cone can be adjusted so that with a given length the average input impedance as in this case is about 95 ohms. The cones nearest the transmission line determine the useful frequency range of the antenna. The two outer cones provide mechanical strength and minimize stray capacitance and end effect. End effect is due to lowered wave velocity on the antenna and causes the calculated wave length and the actual wave length to be unequal.

d. Transmission Lines. Each biconical antenna is used in conjunction with a shielded twin lead transmission line, Cord CD–927. The characteristic impedance of the transmission line is approximately 95 ohms. The slight mismatch that occurs at the frequency extremes of each band does not seriously affect the performance of the radio set.

49. Low-Frequency Rf Amplifier

(figs. 19–21)

a. In the R–593/GRR (fig. 19), signals picked up by Antenna AN–170 are coupled through the shielded-pair balanced transmission line to antenna input connector J2. A short length of transmission line connects between connector J2 and two low impedance taps on L16, which is the input inductance for rf amplifier V3. The rf amplifier uses a type 6J6 tube in a push-pull circuit with both input and output circuits tuned to the same frequency. Inductance L16 is tuned to resonance by capacitors C19A and C19B. Output inductance L18 is tuned by capacitors C25A and C25B. Capacitor C25C is a plate circuit trimmer adjustment for tracking purposes.

b. The low-frequency rf amplifier stage provides amplification of signals in the 145- to 300-mc range. Uniform gain for this stage is maintained over the tuning range, by mechanically ganging the input and output tuning capacitors, C19 and C25, respectively.

c. Self-oscillation is prevented in the push-pull triode circuit by cross-neutralization through capacitors C21 and C22.

d. Rf choke L19 and capacitor C12 isolate the

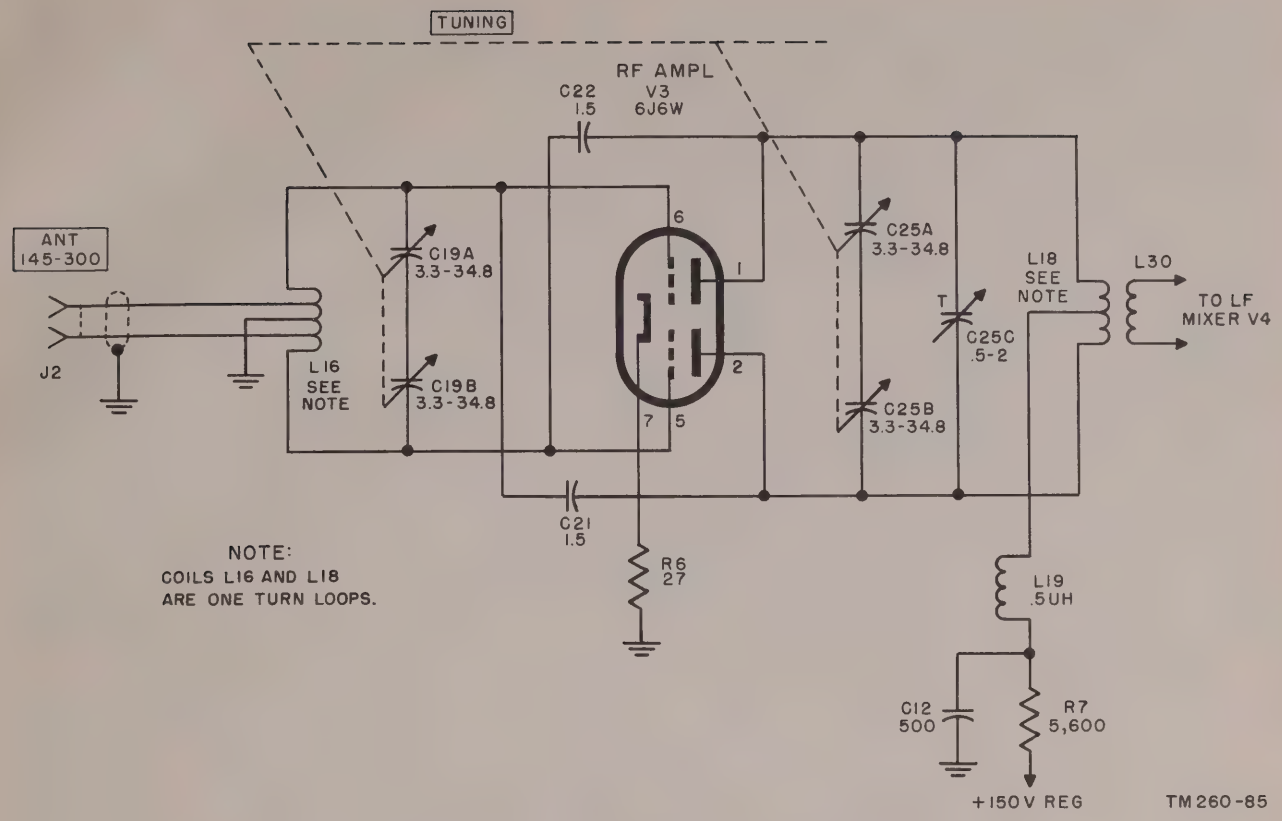


Figure 19. Radio Receiver R–593/GRR, low-frequency rf amplifier circuit.

plate circuit of V3 and prevent rf voltages from entering the dc supply circuit. Plate voltage to the low-frequency rf amplifier is not switched, but is supplied continuously from the 150-volt regulated source through dropping resistor R7. Cathode bias is furnished by the voltage drop across resistor R6.

e. The low-frequency rf amplifier in Radio Receiver BC–1269 (fig. 20) uses a duotetrode 7G8 tube instead of a duotriode as in the R–593/GRR,

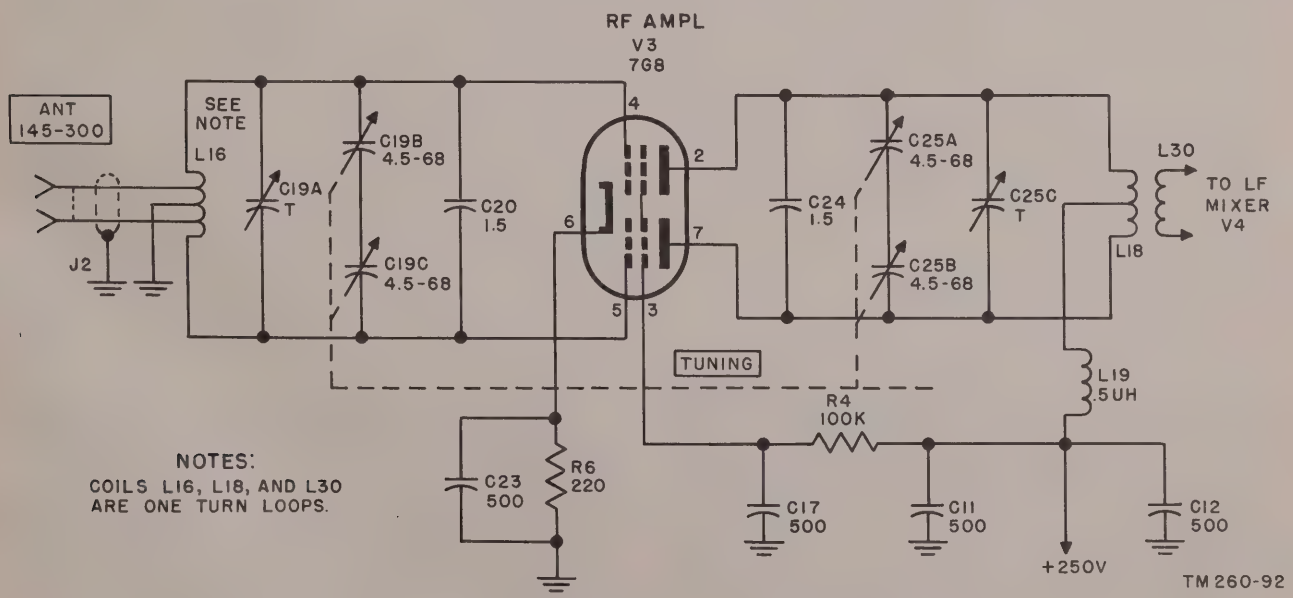


Figure 20. Radio Receiver BC–1269, low-frequency rf amplifier circuit.

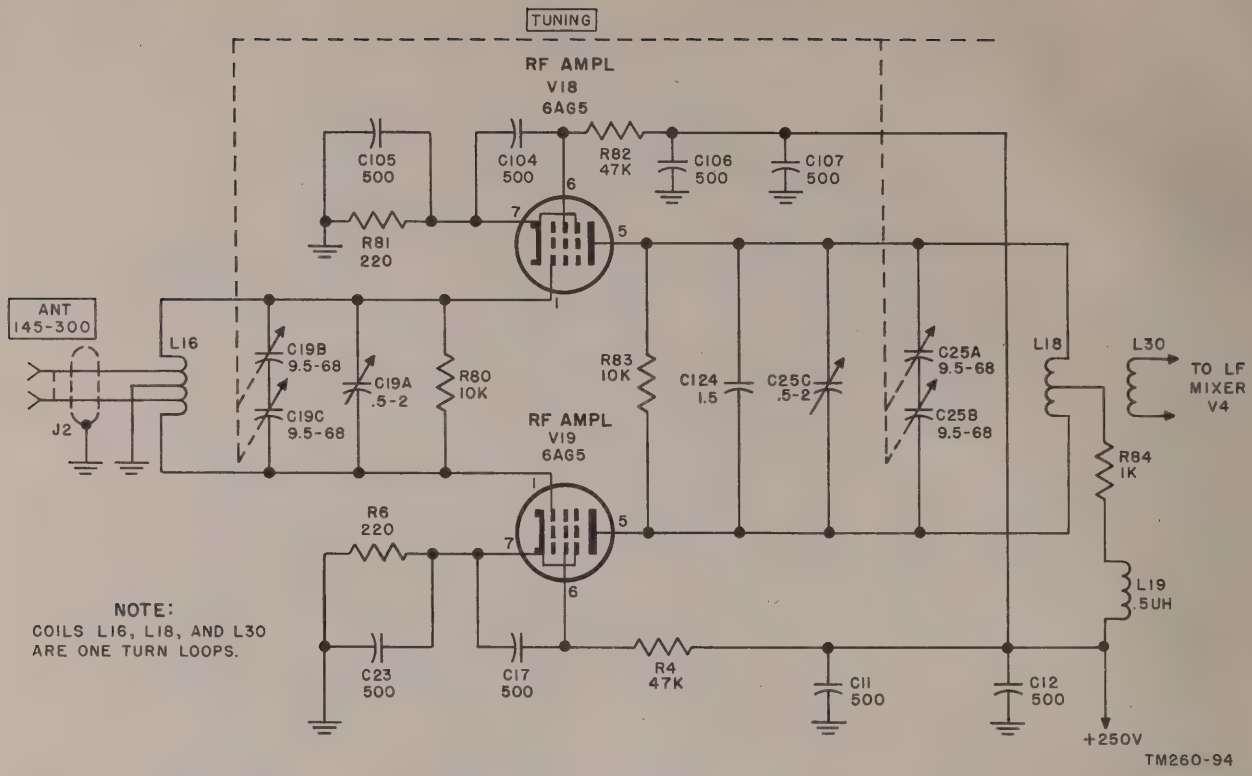


Figure 21. Radio Receiver BC–1269–A, low-frequency rf amplifier circuit.

and the neutralization circuit is not necessary. The grid and plate circuits are tuned with ganged capacitors as in the R–593/GRR, but there are trimmer capacitors for both circuits. These are the only major differences in the circuits.

f. The low-frequency rf amplifier in Radio Receiver BC–1269–A (fig. 21) employs two 6AG5 pentode tubes instead of a duotriode as in the R–593/GRR. No neutralization circuit is necessary, and the circuit uses loading resistors R80 and R83 to broaden the band pass of the grid and plate circuits. Both grid and plate circuits have trimmer capacitors (C19A and C25C) for tracking purposes.

50. Low-Frequency Oscillator

(fig. 22)

a. Low-frequency oscillator V5 uses a type 9002 tube in a ultraudion oscillator which is a modified Colpitts circuit with the inductance split into two parts (L27 and L28). The capacitors that normally provide the necessary voltage division in the grid and plate circuits of a Colpitts oscillator consist of the plate-to-cathode and the grid-to-cathode interelectrode capacitances in this circuit. The oscillator tunes to a frequency 15 mc higher than the rf and mixer stages. Plate voltage is applied only when FREQUENCY BAND switch S1 is in the 145–300 MC position.

b. The oscillator frequency is varied by capacitors C31A and C31B which are ganged to the main tuning drive.

c. Capacitors C32 and C33 form part of the oscillator tuned circuit. Capacitor C29 and resistor R8 for a grid-leak bias arrangement; capacitor C29 has a negative temperature coefficient which aids in stabilizing the oscillator frequency with ambient temperature change. The combination of capacitor C30, resistor R9, and capacitor C36 forms a low-pass filter which isolates test point C from the rf voltage on the oscillator grid and allows a voltage measurement across resistor R12 without disturbing the operation of the oscillator.

d. The if. signal from the mixer stage is fed through a low impedance cable to FREQUENCY BAND switch S1 and then to the first if. amplifier.

e. For low-frequency operation in the R–593/GRR, resistor R80 is shorted out by section 2 of switch S1. Resistor R80 allows a trickle current to flow in the plate circuits of the lf oscillator and lf mixer when switch S1 is set for high-frequency

operation. The BC–1269 and BC–1269–A oscillator circuits are essentially the same as the R–593/GRR.

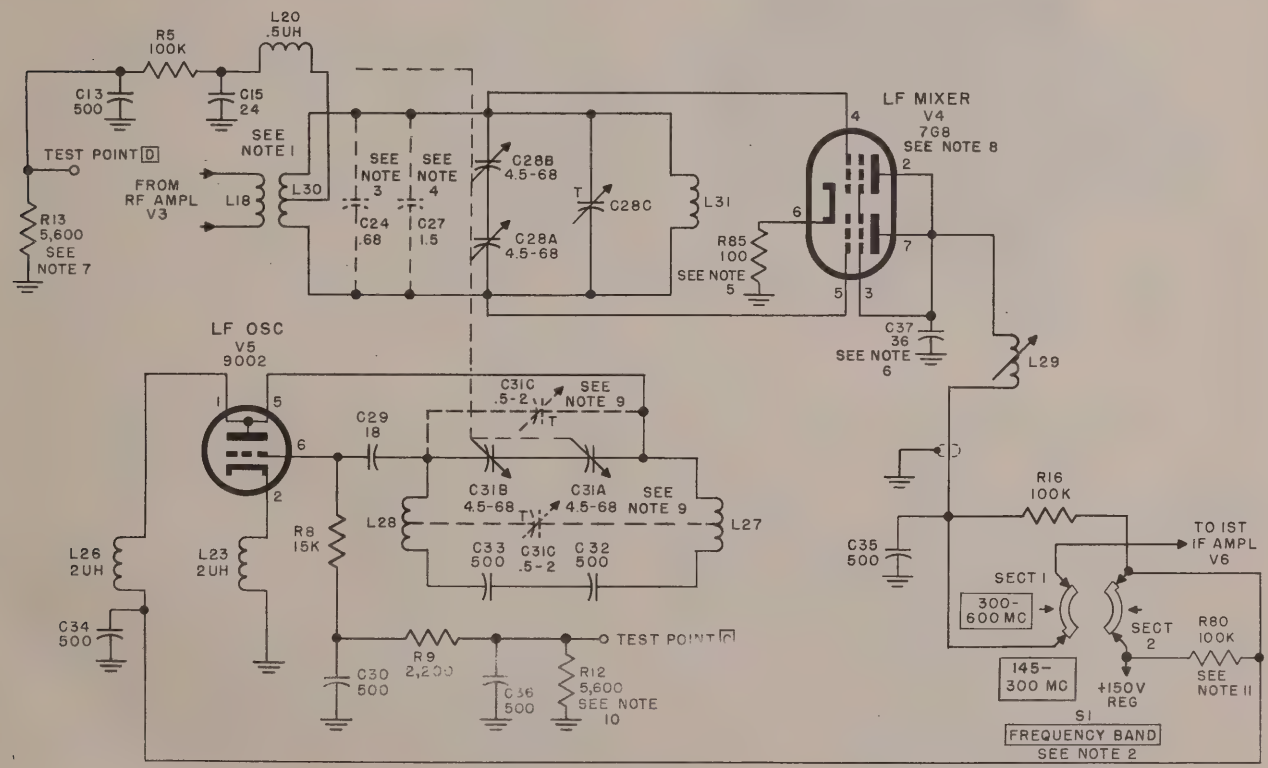
51. Low-Frequency Mixer
(fig. 22)

a. In the R–593/GRR and BC–1269–A, low-frequency mixer stage V4 uses a type 6J6 duotriode tube in a push-pull circuit. The BC–1269 uses a type 7G8 duotetrode tube triode connected, in the same type of circuit. The signal from rf amplifier V3 (or V18 and V19 in the BC–1269–A) is inductively coupled to L30, and the signal from the oscillator is inductively coupled to L31. Coil L30 is continuously tuned by variable capacitors C28A and C28B, which are ganged to the main tuning drive. Capacitors C24 and C27 provide minimum capacity for the mixer tuned circuit. Capacitor C28C is a trimmer adjustment for the high-frequency end of the tuning range.

b. The combined signals are applied to the push-pull grid circuit of the mixer tube whose plate circuit (L29, C37 and C35) is tuned to the difference frequency which is 15 mc. The grid return of V4 is carried to test point D for voltage measurements, and components L20, C15, R5, and C13 isolate the grid from the test point. The plate voltage for the mixer is supplied through section 2 of switch S1, resistor R16, and coil L29. Resistor R80 allows a trickle current to flow when the hf band operation is selected. Cathode bias in the BC–1269–A and R–593/GRR is obtained from the voltage drop across resistor R85.

52. High-Frequency Mixer
(figs. 23 and 24)

a. Tuning in the mixer and oscillator stages in the high-frequency band is accomplished by a special type capacitor which includes the necessary tuning inductances as an integral part of its



NOTES:

1. COILS L27 AND L28 ARE INDUCTIVELY COUPLED TO COIL L31. COILS L18, L27, L28, L30, AND L31 ARE ONE TURN LOOPS.
2. SWITCH S1 IS VIEWED FROM END OPPOSITE KNOB, AND IN 145-300 MC POSITION.
3. CAPACITOR C24 IS USED IN RADIO RECEIVER R-593/GRR ONLY.
4. CAPACITOR C27 IS USED IN RADIO RECEIVER BC-1269 ONLY.
5. RESISTOR R85 IS NOT USED IN RADIO RECEIVER BC-1269-A.
6. CAPACITOR C37 IS 39UUF IN RADIO RECEIVER BC-1269-A.
7. RESISTOR R13 IS 6,800 OHMS IN RADIO RECEIVER BC-1269-A.
8. LF MIXER IS A TUBE TYPE 6J6 IN RADIO RECEIVERS R-593/GRR AND BC-1269-A.
9. CAPACITOR C31C,.5-2UUF IS CONNECTED IN PARALLEL WITH CAPACITORS C31A AND C31B IN RADIO BC-1269, AND BETWEEN CENTER POINTS OF COILS L28 AND L27 IN RADIO RECEIVER BC-1269-A. IT IS NOT USED IN RADIO RECEIVER R-593/GRR.
10. RESISTOR R12 IS 6,800 OHMS IN RADIO RECEIVER BC-1269-A.
11. RESISTOR R80 IS USED IN RADIO RECEIVER R-593/GRR ONLY.

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Figure 22. Low-frequency oscillator and mixer circuits.

physical structure. Figure 23 shows a view of these special tuning capacitors, C1 and C3, as they are oriented on the receiver chassis with respect to tube sockets X1 and X2 and if. transformers T1 and T2. The hf mixer tube is mounted in socket X1; the hf oscillator tube is mounted in socket X2. Inductors L2, L3, L7, and L8 are formed by the supporting rods for the stator plates of the tuning capacitors. The exact inductance of each support rod is determined by the diameter and length of the rod. The spacing and orientation of the two tuning capacitors permit inductive coupling between the parallel support rods which form inductors L3 and L7. The rf input signal is applied to the 1-turn loop which forms inductance L1. The proximity of L1 and the support rod which forms inductance

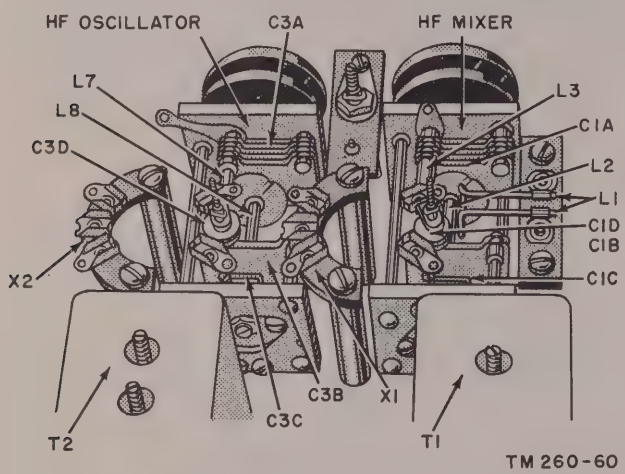


Figure 23. High-frequency oscillator and mixer sections.

L2 permits inductive coupling of the signal to the mixer stage.

b. Capacitors C1C and C3C each uses a circular rotor plate which maintains an effectively constant capacitance with rotation of the tuning shaft. Capacitors C1C and C3C function to couple the components of their associated circuits. Capacitors C1D and C3D are trimmers for their respective tuned circuits.

c. The hf mixer stage V1 uses a 9005 vhf diode (fig. 24). Signals picked up by Antenna AN–169 are coupled through the shielded-pair balanced transmission line to connector J1. A small center-tapped loop, L1, couples the rf energy into the hf mixer stage. The signals from the antenna and from oscillator stage V2 are combined in the hf mixer to produce an if. signal whose frequency is 15 mc. The oscillator voltage is inductively coupled to the mixer tuned circuit by the proximity of the supporting rods on capacitors C1 and C3.

d. The if. output, which is developed across slug tuned coil L14 and capacitors C4 and C9, is carried by a low impedance line to FREQUENCY BAND switch S1 and then to the input of first if. amplifier V6.

e. Inductor L9 and capacitor C4 comprise a low-pass filter which isolates the input and output circuits of the mixer stage. Capacitors C8 and C9, and resistor R3, in the plate circuit of V1, serve as an isolation filter for test point A which allows a voltage measurement across resistor R10. Coil L4 provides a dc ground return for the cathode (pin 2). The mixer stage requires no plate voltage.

53. High-Frequency Oscillator
(fig. 24)

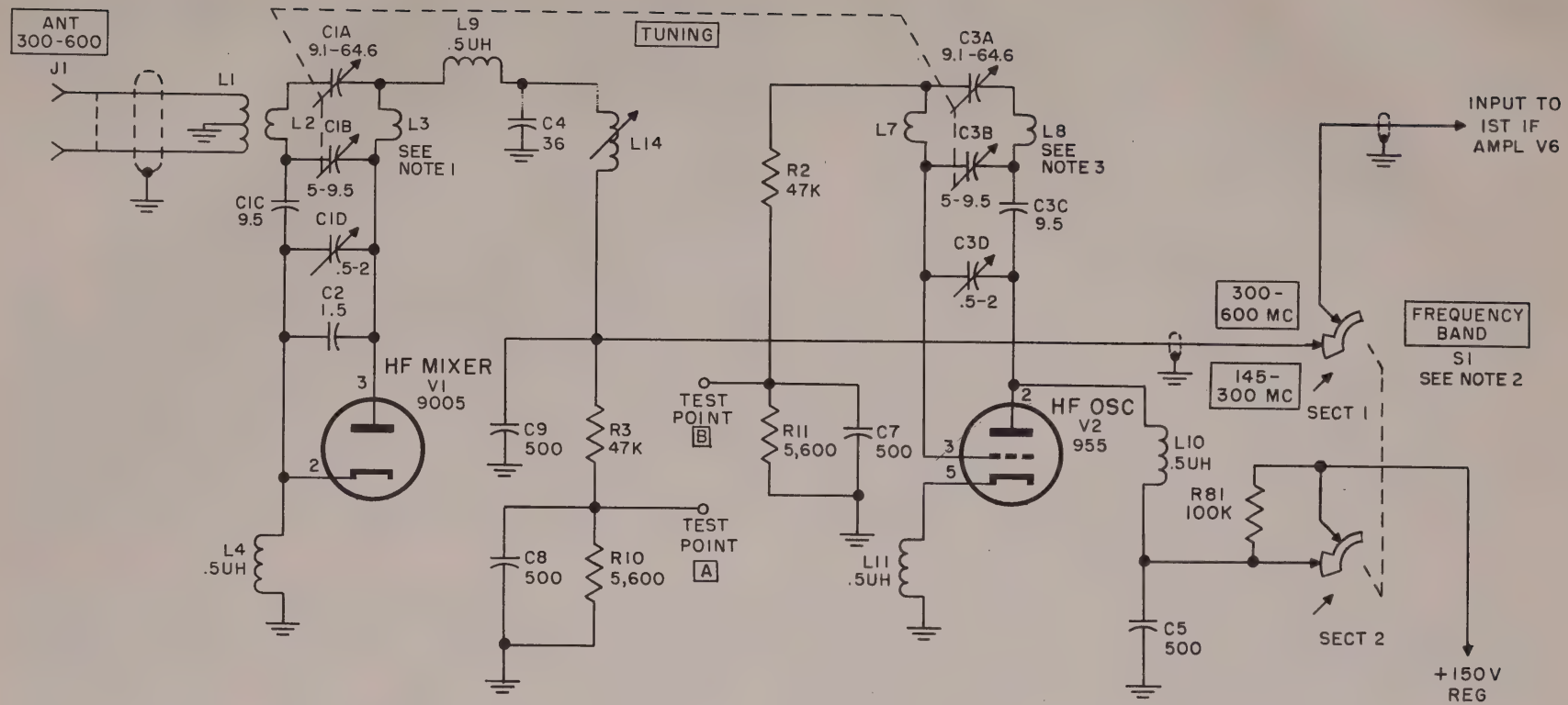
a. Oscillator stage V2 uses a type 955 tube in an ultraudion circuit the same as the if. oscillator circuit which tunes to a frequency 15 mc lower than the mixer stage. Inductances L7 and L8 are integral parts of capacitor C3 and function in a manner similar to the inductances formed by capacitor C1 (par. 52).

b. The oscillator is coupled to the mixer stage by the proximity of coils L3 and L7 which are part of the tuned circuits associated with capacitors C1 and C3.

c. Capacitor C3D is a trimmer capacitor used in the alinement of the oscillator. Resistor R2, in conjunction with the circuit wiring capacitance, is used to furnish grid-leak bias. Capacitor C7 provides rf bypassing for the lead to test point B which allows a voltage measurement across resistor R11. Coil L10 maintains the plate (pin 2 of V2) at a high rf potential since the plate voltage is shunt fed. Capacitor C5 provides rf bypassing in the dc plate supply lead from FREQUENCY BAND switch S1. Dc voltage is applied to the oscillator only when switch S1 is in the 300–600 MC position.

d. Coil L11 is an rf choke which maintains the cathode (pin 5) at a high rf potential while providing a dc return to ground.

e. For hf operation, resistor R81 is shorted out by section 2 of switch S1. Resistor R81 allows a trickle current to flow in the plate circuit of the hf oscillator when switch S1 is set for if. operation.



NOTES:

1. L3 IS INDUCTIVELY COUPLED TO L7.
2. SWITCH S1 VIEWED FROM END OPPOSITE KNOB, AND IN 300-600 MC POSITION.
3. INDUCTORS L2, L3, L7, AND L8 FORMED BY SUPPORTING RODS OF STATOR PLATES OF TUNING CAPACITORS.
4. COMPONENTS LISTED DIFFER FROM THOSE SHOWN ON PARTIAL SCHEMATIC DIAGRAM.

COMPONENT VALUES		
COMPONENT	RADIO RECEIVER BC-1269	RADIO RECEIVER BC-1269-A
C1A	9.5-65	9.5-45
C1B	3.5-20	3.5-20
C1C	9.5	10
C3A	9.5-65	9.5-50
C3B	3.5-20	3.5-20
C3C	9.5	10
R10	5,600	6,800
R11	5,600	6,800
R81	NOT USED	NOT USED

SEE NOTE 4

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Figure 24. High-frequency oscillator and mixer circuits.

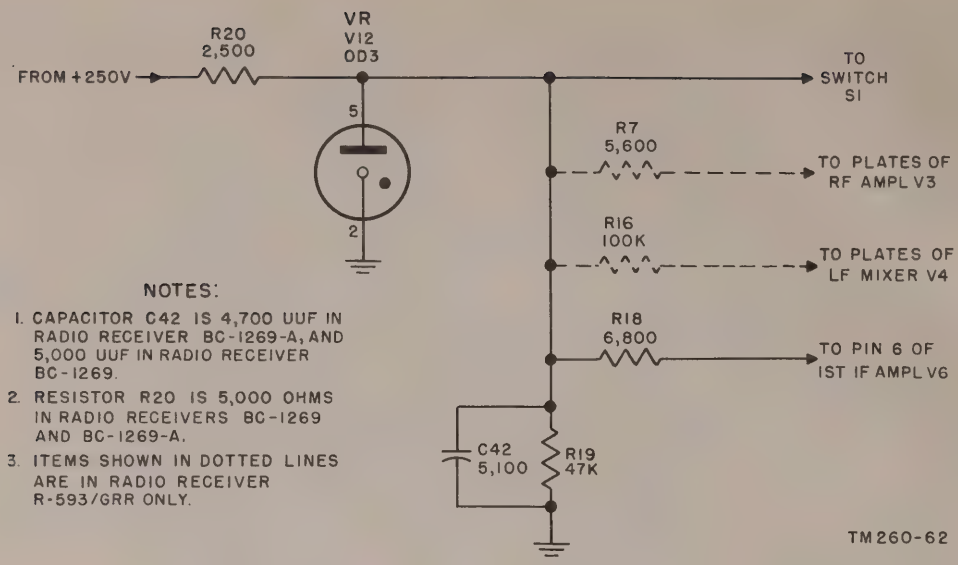


Figure 25. Voltage regulator circuit.

54. Voltage Regulator
(fig. 25)

a. For greater frequency stability, it is necessary to maintain a constant voltage with varying load or source voltage at certain points in the circuit of the receiver. This is accomplished by using a voltage regulator circuit (V12) which uses a type OD3 tube.

b. The unregulated B plus voltage is applied to series-connected resistor R20 and the voltage regulator tube. The ±150-volt regulated output is taken between the plate of the voltage regulator tube and ground. Any change in the load presented to the +150-volt source affects the conductivity of the regulator tube so that the current drawn through resistor R20 changes. This results in a change in the voltage drop across R20 that compensates for the original load variation. The result is an automatic control action which maintains the voltage at the output of the regulator circuit at +150 volts.

c. Regulated voltage is supplied to the following points:

(1) Screen grid of first if. amplifier through resistor R18.
(2) Plates of the low-frequency rf amplifier through dropping resistor R7.
(3) Plates of the low-frequency mixer, through dropping resistor R16.
(4) Plate of the low-frequency oscillator and plate of the high-frequency oscillator, depending on the position of FREQUENCY BAND switch S1.

d. In Radio Receivers BC–1269 and BC–1269–A, the plates of the low-frequency rf amplifiers are connected to the +250-volt supply and not to the regulated +150 volts.

55. First If. Amplifier
(fig. 26)

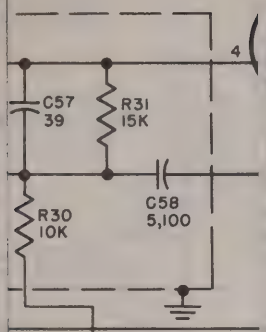
a. Depending on the setting of FREQUENCY BAND switch S1, the 15-mc if. output of either low-frequency mixer stage V4 or high-frequency mixer stage V1 is coupled through capacitor C38 to the primary L34 of first if. transformer T1. The signal is applied through secondary winding L33 to the grid of first if. amplifier V6, which uses a type 6SH7 tube.

b. The secondary winding of transformer T1 is shunted by loading resistor R14, which broadens the frequency response of the amplifier. Fixed capacitor C39 in conjunction with slug tuned winding L33 tunes the secondary to resonance. Resistor R15 and capacitor C40 form a grid decoupling network since the lower end of resistor R15 is connected to the avc bus.

c. Cathode bias is provided by the voltage drop across resistor R17. Capacitor C41 is the cathode rf bypass capacitor.

d. Screen voltage is supplied from a voltage divider consisting of resistors R19 and R18, which are connected in series across the regulated +150-volt supply. The screen is bypassed to ground by capacitor C42.

e. The plate load for V6 consists of primary winding L35 of if. transformer T2, shunted by



VITY

C60A
.1UF

ENT VALUES

RECEIVER 1269	RADIO RECE BC-1269
000	4,700
	39
	USED ONL
	RADIO REC
	BC-126
	NOT USE
	RESISTO
	2,200 OHMS, RE
	COIL L4
	6,800
	220
7K	47K
USED	NOT USE
SH7	

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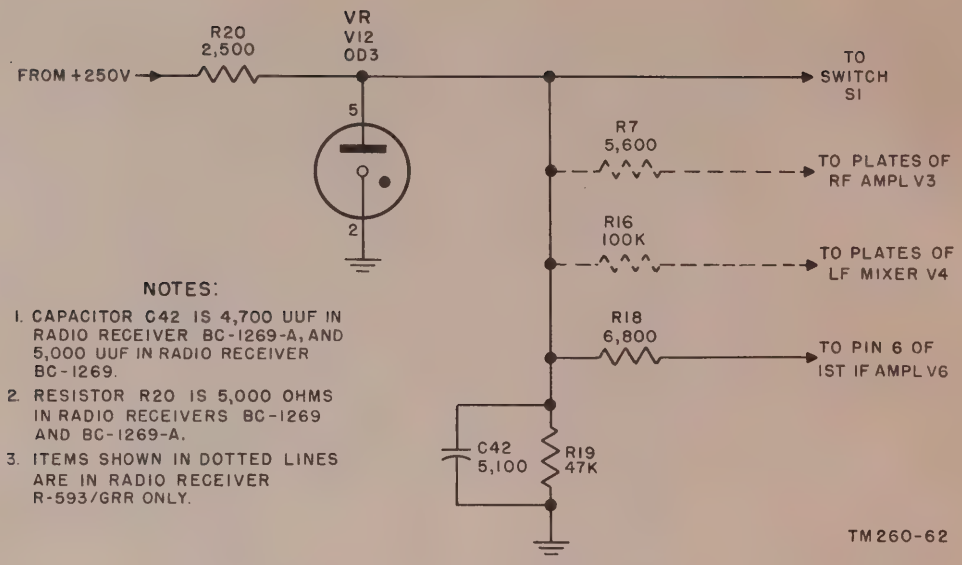


Figure 25. Voltage regulator circuit.

54. Voltage Regulator
(fig. 25)

a. For greater frequency stability, it is necessary to maintain a constant voltage with varying load or source voltage at certain points in the circuit of the receiver. This is accomplished by using a voltage regulator circuit (V12) which uses a type OD3 tube.

b. The unregulated B plus voltage is applied to series-connected resistor R20 and the voltage regulator tube. The ±150-volt regulated output is taken between the plate of the voltage regulator tube and ground. Any change in the load presented to the +150-volt source affects the conductivity of the regulator tube so that the current drawn through resistor R20 changes. This results in a change in the voltage drop across R20 that compensates for the original load variation. The result is an automatic control action which maintains the voltage at the output of the regulator circuit at +150 volts.

c. Regulated voltage is supplied to the following points:

(1) Screen grid of first if. amplifier through resistor R18.
(2) Plates of the low-frequency rf amplifier through dropping resistor R7.
(3) Plates of the low-frequency mixer, through dropping resistor R16.
(4) Plate of the low-frequency oscillator and plate of the high-frequency oscillator, depending on the position of FREQUENCY BAND switch S1.

d. In Radio Receivers BC–1269 and BC–1269–A, the plates of the low-frequency rf amplifiers are connected to the +250-volt supply and not to the regulated +150 volts.

55. First If. Amplifier
(fig. 26)

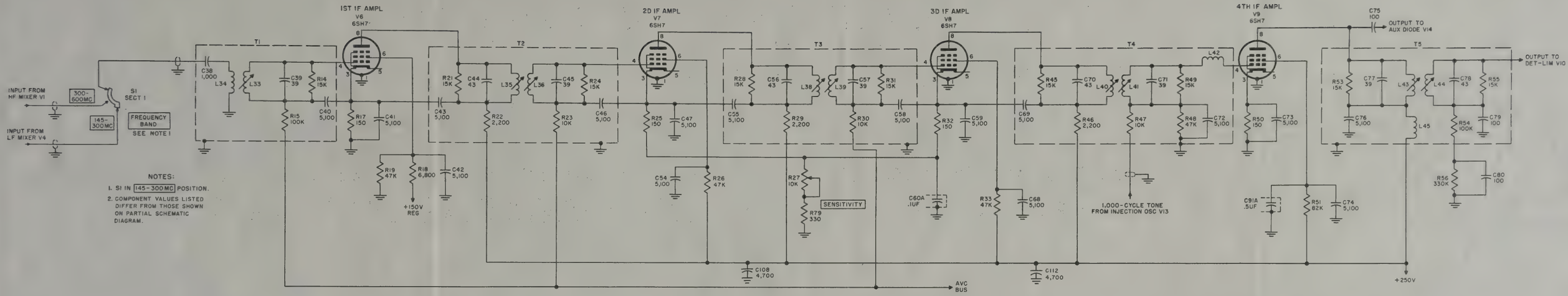
a. Depending on the setting of FREQUENCY BAND switch S1, the 15-mc if. output of either low-frequency mixer stage V4 or high-frequency mixer stage V1 is coupled through capacitor C38 to the primary L34 of first if. transformer T1. The signal is applied through secondary winding L33 to the grid of first if. amplifier V6, which uses a type 6SH7 tube.

b. The secondary winding of transformer T1 is shunted by loading resistor R14, which broadens the frequency response of the amplifier. Fixed capacitor C39 in conjunction with slug tuned winding L33 tunes the secondary to resonance. Resistor R15 and capacitor C40 form a grid decoupling network since the lower end of resistor R15 is connected to the avc bus.

c. Cathode bias is provided by the voltage drop across resistor R17. Capacitor C41 is the cathode rf bypass capacitor.

d. Screen voltage is supplied from a voltage divider consisting of resistors R19 and R18, which are connected in series across the regulated +150-volt supply. The screen is bypassed to ground by capacitor C42.

e. The plate load for V6 consists of primary winding L35 of if. transformer T2, shunted by



NOTES:

1. S1 IN 145-300 MC POSITION.
2. COMPONENT VALUES LISTED DIFFER FROM THOSE SHOWN ON PARTIAL SCHEMATIC DIAGRAM.

COMPONENT VALUES		
COMPONENT	RADIO RECEIVER BC-1269	RADIO RECEIVER BC-1269-A
C40 TO C43	5,000	4,700
C44		39
C46	5,000	4,700
C47	5,000	4,700
C54	5,000	4,700
C55	5,000	4,700
C56		39
C58	5,000	4,700
C59	5,000	4,700
C68	5,000	4,700
C69	5,000	4,700
C70		39
C72 TO C74	5,000	4,700

COMPONENT VALUES		
COMPONENT	RADIO RECEIVER BC-1269	RADIO RECEIVER BC-1269-A
C76	5000	4,700
C78		39
C108 AND C112		USED ONLY IN RADIO RECEIVER BC-1269-A
L42		NOT USED
L45		RESISTOR R86, 2,200 OHMS, REPLACES COIL L45
R47		6,800
R50		220
R51	47K	47K
R79	NOT USED	NOT USED
V6 TO V9	12SH7	

SEE NOTE 2

Figure 26. If. amplifier circuits.

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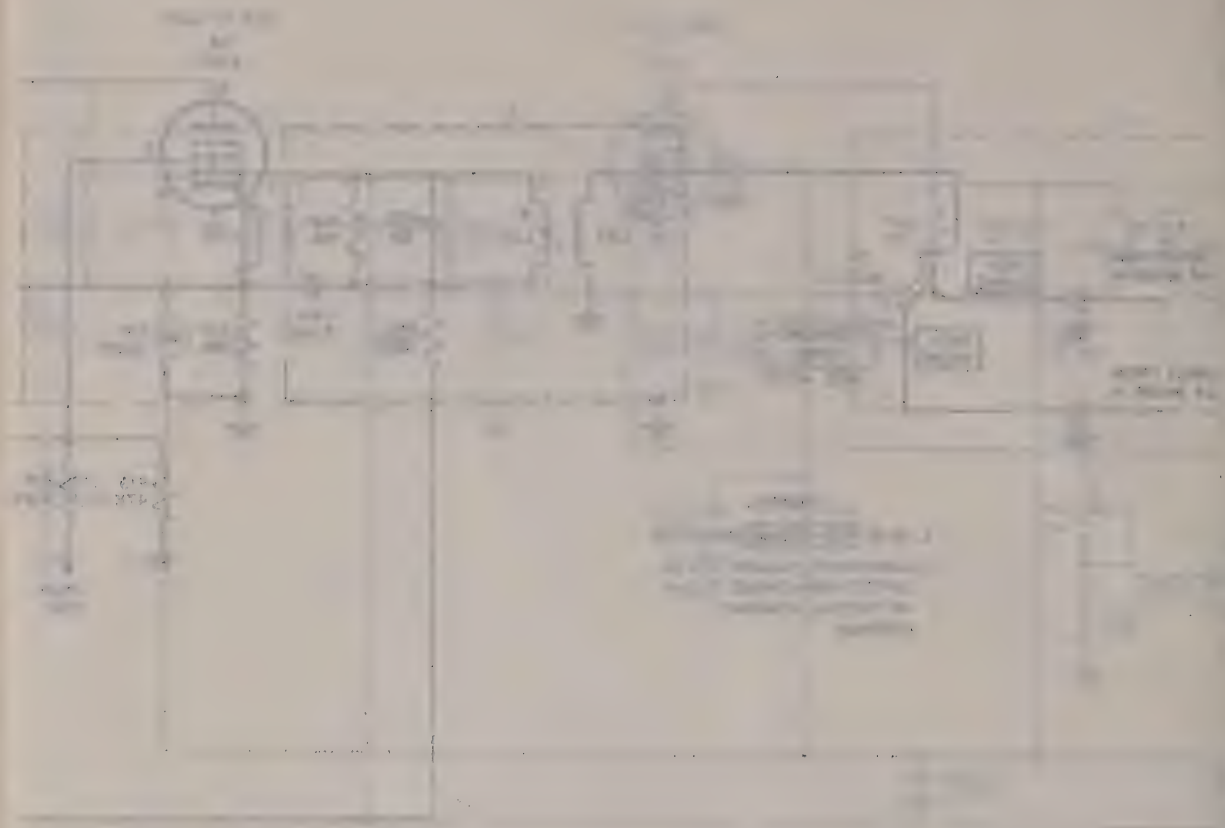


loading resistor R21 and resonated by fixed capacitor C44. The circuit is tuned to resonance by the adjustable powdered iron core in coil L35. The combination of resistor R22 and capacitor C43 forms the plate circuit decoupling filter.

f. The if. stages are essentially the same in all three models of the receiver with the exception that 12SH7 tubes are used in Radio Receiver BC–1269.

56. Second If. Amplifier
(fig. 26)

a. The if. signal is coupled to the grid of second if. stage V7, which uses a type 6SH7 tube, through the primary and secondary windings of transformer T2. Secondary winding L36 is shunted by fixed capacitor C45 and loading resistor R24. The grid circuit is tuned to resonance by an adjustable powdered iron core in L36.

b. The grid of the second if. stage is returned to the avc bus through resistor R23. The combination of resistor R23 and capacitor C46 form the grid decoupling filter.

c. Screen potential is supplied through series-dropping resistor R26, which is bypassed for if. by capacitor C54.

d. Cathode bias is furnished by the voltage drop across cathode resistor R25, SENSITIVITY control R27, and resistor R79. Resistor R27 controls the amplifying action of this stage by adjusting the bias voltage. The cathode (pin 3) is bypassed to ground by capacitor C47.

e. The plate load for the second if. stage consists of primary L38 of transformer T3 shunted by loading resistor R28 and resonated by fixed capacitor C56. The circuit is tuned to resonance by a powdered iron slug in L38. The combination of resistor R29 and capacitor C55 decouples the plate circuit from the dc supply.

57. Third If. Amplifier
(fig. 26)

a. The 15-mc if. signal is inductively coupled into secondary L39 of transformer T3 and is impressed on the grid of the third if. stage, V8, which uses a type 6SH7 tube. Slug-tuned inductor L39 tunes capacitor C57 to resonance, and the frequency response is broadened by loading resistor R31. The grid circuit is returned to the avc bus through resistor R30, which in combination with capacitor C58 serves to decouple the grid circuit.

b. Screen voltage is supplied through series dropping resistor R33. Capacitor C68 bypasses the screen circuit to ground.

c. The gain of this stage is controlled by varying the cathode bias. This is accomplished by returning the cathode to ground through resistor R32, SENSITIVITY control R27, and resistor R79. Resistor R79 provides a minimum bias when SENSITIVITY control R27 is set at zero resistance. Resistors R27 and R79 are bypassed for if. by capacitor C60A in order to minimize degeneration. Cathode resistor R32 is bypassed to ground for if. by capacitor C59.

d. The plate load impedance for the third if. stage consists of the primary L40 of T4, shunted by damping resistor R45 and resonated by capacitor C70. The circuit is tuned to resonance by a powdered iron slug in L40. Decoupling between the plate circuit and the dc supply is provided by resistor R46 and capacitor C69.

58. Fourth If. Amplifier
(fig. 26)

a. The if. signal is coupled through tuned secondary L41 of transformer T4 to the grid of fourth if. amplifier V9, which uses a type 6SH7 tube. The circuit is tuned to resonance by capacitor C71 and an adjustable powdered iron core in coil L41. Inductor L42 in the R–593/GRR and BC–1269 acts as an rf choke to suppress any tendency of this stage to oscillate because of rf feedback. Loading resistor R49 broadens the frequency response of the stage.

b. When the BEAT-NOTE BALANCE control is adjusted for the reception of cw signals, the modulating audio tone from the injection oscillator appears across resistors R47 and R48 which form a voltage divider in the grid circuit. This audio tone is detected later in the demodulation process. Resistor R48 also provides a dc return for the grid (pin 4) of V9. Capacitor C72 bypasses the lower end of the grid-tuned circuit for if. frequencies. Cathode bias for the stage is furnished by the voltage drop across resistor R50, which is bypassed by capacitor C73.

c. Screen voltage is supplied through series dropping resistor R51, which is bypassed for if. frequencies by capacitors C74 and C91A.

d. The plate load impedance for the stage consists of the parallel resonant circuit that includes slug-tuned primary L43 of transformer T5 and fixed capacitor C77. Loading resistor R53 broadens the frequency response of the stage.

Coil L45, in conjunction with capacitor C76, provides plate decoupling. A portion of the if. signal present at the plate of this stage is coupled through capacitor C75 to the auxiliary diode circuit (par. 59).

59. Auxiliary Diode
(fig. 27)

a. Auxiliary diode rectifier V14, which uses a type 6H6 tube, provides a dc output voltage proportional to signal strength when the receiver is used with direction-finding equipment. The associated circuit is terminated in connector J4 on the rear apron of the receiver chassis. The connector permits a positive or negative output voltage to be selected, depending on the indicating equipment requirements. For positive voltage output, terminal C on J4 is grounded, and the indicating equipment is connected to terminals A and B. For negative voltage output, terminal A is grounded, and connection is made to terminals C and B. Connector AN–3106–14S–1P (par. 12) is supplied to facilitate connection to the indicating equipment.

b. Capacitor C75 couples a portion of the 15-mc if. signal to the diode plate (pin 5) of V14. Resistor R63 forms a part of the diode load. Capacitors C92 and C93 maintain output terminals C and A at if. ground potential. The rectified output voltage appears across terminals A and C and may be used for tuning purposes by connecting a suitable microammeter across these terminals. Radio Receiver BC–1269 uses a type 12H6 tube as the auxiliary diode.

60. Am Detector Circuit
(fig. 28)

Detector-limiter stage V10 functions as either an am detector or as an fm limiter, depending on the type of operation required. Operation of V10 as an am detector is discussed in *a* through *f* below. For a discussion of V10 as an fm limiter, refer to paragraph 61.

a. When MVC–AVC–FM switch S4 is set to MVC or AVC, V10 functions as an am detector. The signal from fourth if. stage V9 is coupled through transformer T5 and appears at the grid of detector limiter V10, which uses a type 6SH7 tube. Since plate and screen voltages are disconnected by switch S4, section 3, the tube functions as a diode detector with the control grid acting as the diode plate.

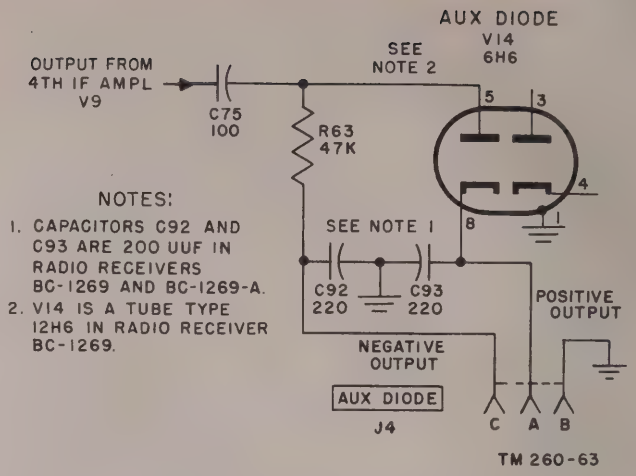


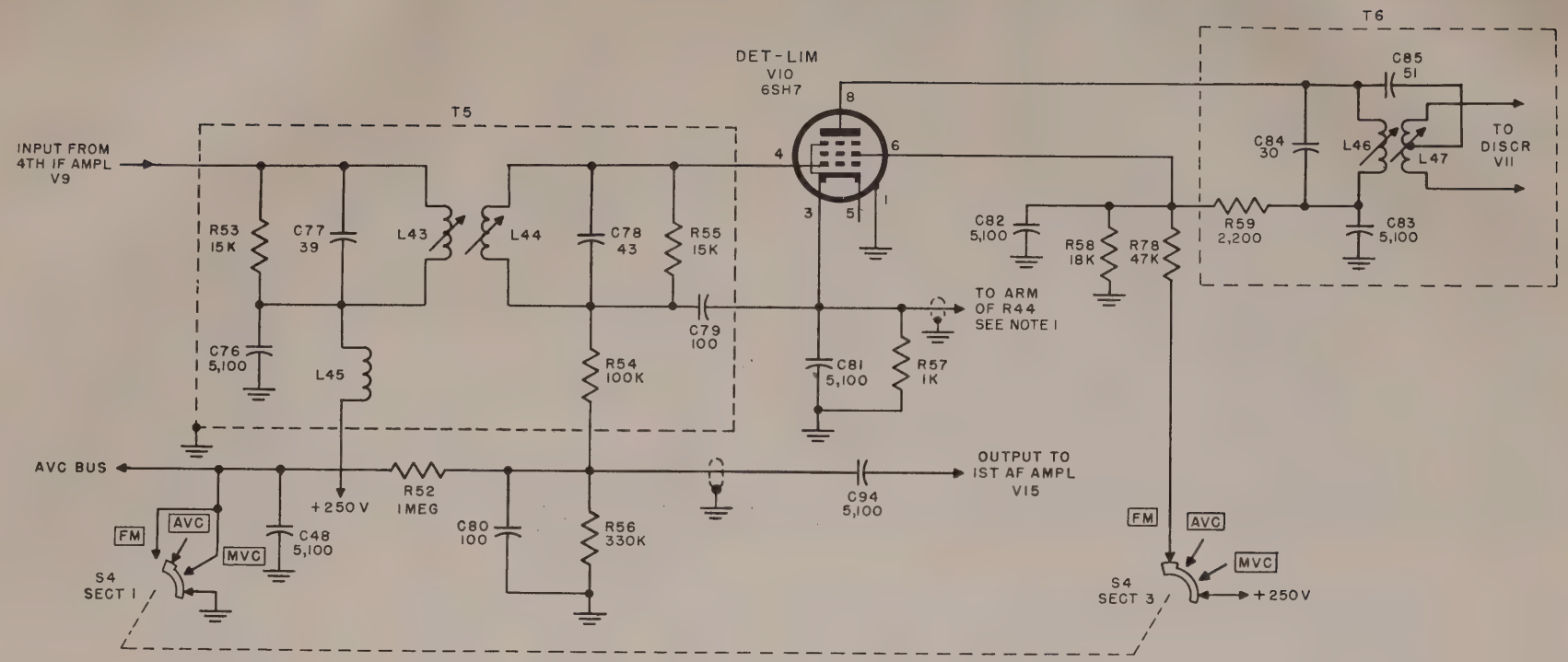
Figure 27. Auxiliary diode circuit.

b. The diode input circuit is tuned to resonance by slug-tuned secondary L44 of transformer T5, in parallel with capacitor C78. Loading resistor R55 broadens the frequency response of the circuit.

c. Demodulation of the am signal is accomplished by rectification. The grid (pin 4), which acts as the diode plate, draws current on each positive half-cycle of the impressed if. signal. The demodulated audio voltage appears across resistors R54 and R56. Capacitor C80 removes the 15-mc if. component across R56. The audio voltage across R56 is coupled through capacitor C94 to the control grid (pin 4) of first audio frequency (af) amplifier V15A.

d. The voltage across resistor R56 is also applied to the avc filter network consisting of resistor R52 and capacitor C48. This network removes the af component present in the rectified output from the am detector, but retains the negative dc output voltage whose amplitude varies only when the average carrier level of the received signal varies. When the MVC–AVC–FM switch is in the AVC position, avc voltage is supplied to the grid circuits of the first, second, and third if stages; this automatically maintains uniform receiver gain. The avc circuit is disabled when operation is on MVC or FM. This is accomplished by shorting the avc bus to ground through the MVC or FM position of switch S4, section 1.

e. For avc operation, the cathode of V10 is grounded directly through the arm of the BEAT-NOTE BALANCE control; resistor R57 and capacitor C81 are used when manual volume control (mvc) operation is selected (par. 63).



NOTES:

1. FOR AVC OPERATION, CATHODE (PIN 3) OF V10 IS GROUNDED THROUGH ARM OF R44.
2. COMPONENTS LISTED DIFFER IN VALUE FROM THOSE SHOWN ON PARTIAL SCHEMATIC DIAGRAM.

COMPONENT VALUES		
COMPONENT	RADIO RECEIVER BC-1269	RADIO RECEIVER BC-1269-A
C48	5,000	4,700
C76	5,000	4,700
C78		39
C81	5,000	4,700
C82	5,000	4,700
C83	5,000	4,700
C84		27
C94	5,000	4,700
L45		REPLACED BY R86, 2,200 OHMS
R58		10K
R78		REPLACED BY R87, 47K OHMS
V10	12SH7	

SEE NOTE 2

TM260-68

Figure 28. Am detector-limiter circuit.

f. Radio Receiver BC–1269 uses a type 12SH7 tube for the detector-limiter stage.

61. Fm Limiter Circuit

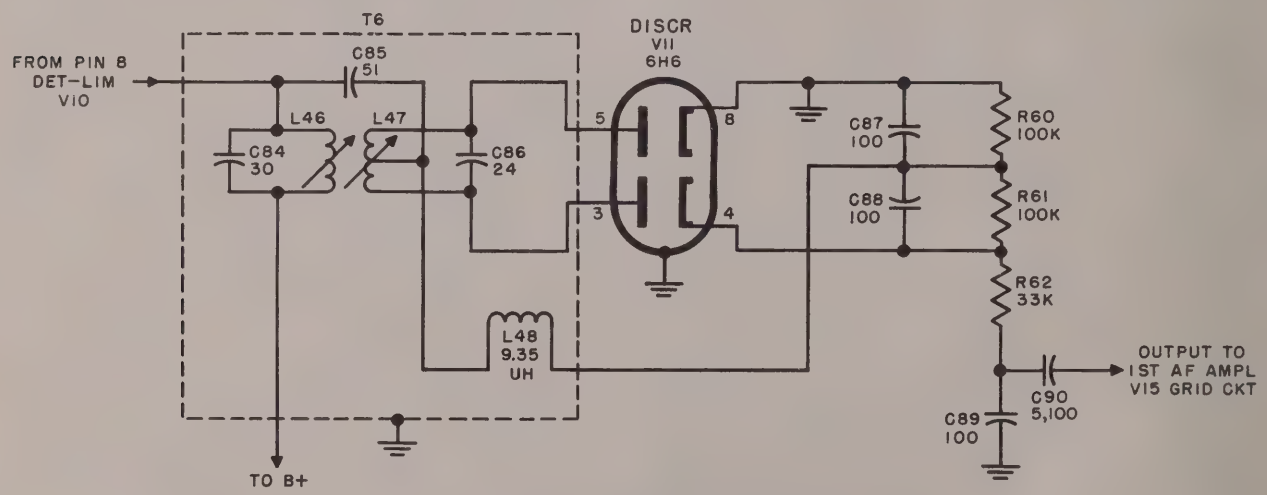
(fig. 28)

a. The limiter stage in an fm receiver maintains the amplitude of the voltage fed to the discriminator at a constant level. This is accomplished in the receiver by reducing the plate and screen voltage to the limiter stage and driving the tube to plate current saturation. For best results, the input signal to the discriminator must be constant in amplitude, otherwise amplitude variations, such as noise or residual am contained in the fm signal, may be detected by the discriminator. When the fm signal from fourth if. stage V9, which also may contain amplitude variations, is sufficient to cause saturation of limiter stage V10, the output voltage across primary L46 of transformer T6 will be of constant amplitude but of varying frequency. For a discussion of V10 as an am detector, refer to paragraph 60.

b. When MVC–AVC–FM switch S4 is set to FM, plate and screen voltages are applied to V10 through section 3, and V10 now functions as an fm limiter. Resistors R58 and R78 form a voltage divider from which screen voltage is supplied directly. The plate circuit has an additional series dropping resistor, R59, which acts in combination with capacitor C83 to decouple the plate circuit. The lowered plate and screen potentials supplied to V10 determine the limiting characteristics of the tube.

c. The signal voltage is induced in secondary winding L44 of transformer T5. The secondary is tuned to resonance with capacitor C78 by means of the powdered iron slug in the winding. Loading resistor R55 broadens the frequency response of the circuit. Capacitor C79 returns the lower end of the grid-tuned circuit to ground for if. frequencies. Resistors R54 and R56 and capacitor C80 provide grid-leak bias for fm reception and are used as a detector load and filter for reception of cw or am signals. The large signal amplitude causes plate current saturation and, as a result, the output voltage developed across the parallel resonant plate circuit is constant.

d. For fm reception, the avc circuit is inoperative to allow a maximum signal amplitude at the limiter stage. The avc bus is grounded through section 1 of MVC–AVC–FM switch S4. In addition, BEAT–NOTE BALANCE control R44 must



NOTE:
COMPONENTS LISTED DIFFER IN VALUE FROM THOSE SHOWN IN PARTIAL SCHEMATIC DIAGRAM.

COMPONENT VALUES		
COMPONENT	RADIO RECEIVER BC–1269	RADIO RECEIVER BC–1269–A
C84		27
C86		27
C90	5000	4700
L48		REPLACED BY RESISTOR R88 6,800 OHMS
V11	12H6	

SEE NOTE

TM260–96

Figure 29. Discriminator circuit.

be switched to OFF. In this position, the cathode (pin 3) of the limiter returns directly to ground through the arm of resistor R44 to remove cathode bias resistor R57 from the circuit.

62. Fm Discriminator Circuit

(figs. 29 and 30)

a. General. The receiver uses a standard Foster-Seely discriminator circuit for the detection of fm signals. The discriminator converts the frequency-modulated carrier at the input to an audio frequency at the output. This audio output which is the same as the original modulation, is then applied to the first af amplifier.

b. Circuit. The signal from primary L46 of transformer T6 is coupled to secondary L47, over two paths; by inductive coupling between the primary and secondary windings of the transformer, and by capacitive coupling through capacitor C85 (fig. 29). Both the primary and secondary circuits are tuned to resonance at the if. frequency. Slug-tuned winding L46 resonates with capacitor C84; slug-tuned winding L47 resonates with capacitor C86. The operation of the discriminator depends on the phase relationships of the voltages and currents in a tuned transformer. The vector relationships of the various currents and voltages are shown in figure 30. Primary current Ip lags primary voltage Ep by 90°. The primary voltage is also directly coupled to center-tapped secondary coil L47, and since L48, or resistor R88 in the BC–1269–A, completes the rf path to ground from this point, the voltage drop across L48 is nearly equal to Ep and in phase with it. The voltage drop across L48 or E_L can replace Ep for all practical purposes in the vector diagrams. The flux produced by the primary current induces a voltage Es in the secondary coil which lags the primary current by 90°. This secondary induced voltage, Es, drives current Is, through the tuned secondary circuit, L47 and C86. Circulating current Is, which is in phase with induced voltage Es at resonance, produces a voltage drop across L47 which differs from the current producing it by 90°. If the center of the coil is used as a reference point, then the voltage drops from the center of the coil to each end, E1 and E2, are equal and 180° out of phase. The first vector diagram in figure 30 shows these phase relationships.

c. At Resonance. The vector diagram at resonance is shown in A, figure 30. The inductive and capacitive reactances are exactly equal at

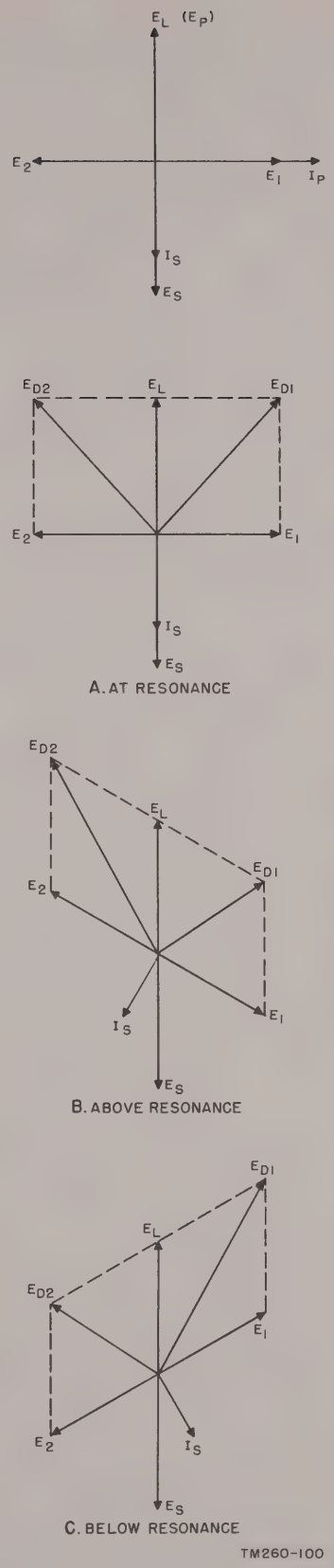


Figure 30. Discriminator vector diagrams.

resonance; therefore, the secondary circuit is purely resistive. Induced voltage Es and secondary current Is are in phase. The total rf voltage applied to diode 1, pins 5 and 8, is the vector sum of E1 and E_L. The total rf voltage applied to diode 2, pins 3 and 4, is the vector sum of E2 and E_L. Since E1 and E2 are equal and both 90° out of phase with E_L, the rf voltage applied to each diode is the same. This causes equal rectified currents to flow through the circuit, and they produce equal voltage drops across the 100K-ohm diode load resistors, R60 and R61. Since the voltage across R60 is negative and the voltage across R61 is positive with respect to ground, the net voltage from the junction of R61 and R62 and ground is zero at resonance.

d. Off Resonance. When the frequency of the signal voltage applied to the discriminator circuit varies above and below the resonant frequency, the circulating current in the secondary tuned circuit alternately leads and lags the induced voltage by some small angle. The value of this angle depends on the amount of frequency deviation and the resistance in the circuit. Thus the secondary tuned circuit is no longer resistive, but alternatively becomes inductive and capacitive. This causes the voltage drops E1 and E2 produced by the circulating current also to change by some small angle (B and C, fig. 30). The voltage applied to each diode plate is the vector sum of voltage E_L, coupled through capacitor C85, and the changing reactive voltages, E1 and E2. As the phase angle of the reactive voltages change, the resultant voltage applied to one diode plate increases while the voltage applied to the other plate decreases. This results in one diode conducting more current than the other. There is a net voltage across resistors R60 and R61 that varies positive and negative with respect to ground, according to the resistor with the larger voltage drop. This output voltage is the original modulation reproduced as an audio-frequency voltage. Capacitors C87 and C88 remove the 15-mc if. component but allow the audio-frequency voltage to appear across load resistors R60 and R61 (fig. 29). Resistor R62 and capacitor C89 form a de-emphasis filter which reduces the high audio frequencies and accompanying noise. Coupling capacitor C90 transfers the signal to the control grid of first af amplifier V15. Radio Receiver BC–1269 uses a tube type 12H6 for the discriminator stage.

63. Injection Oscillator
(fig. 31)

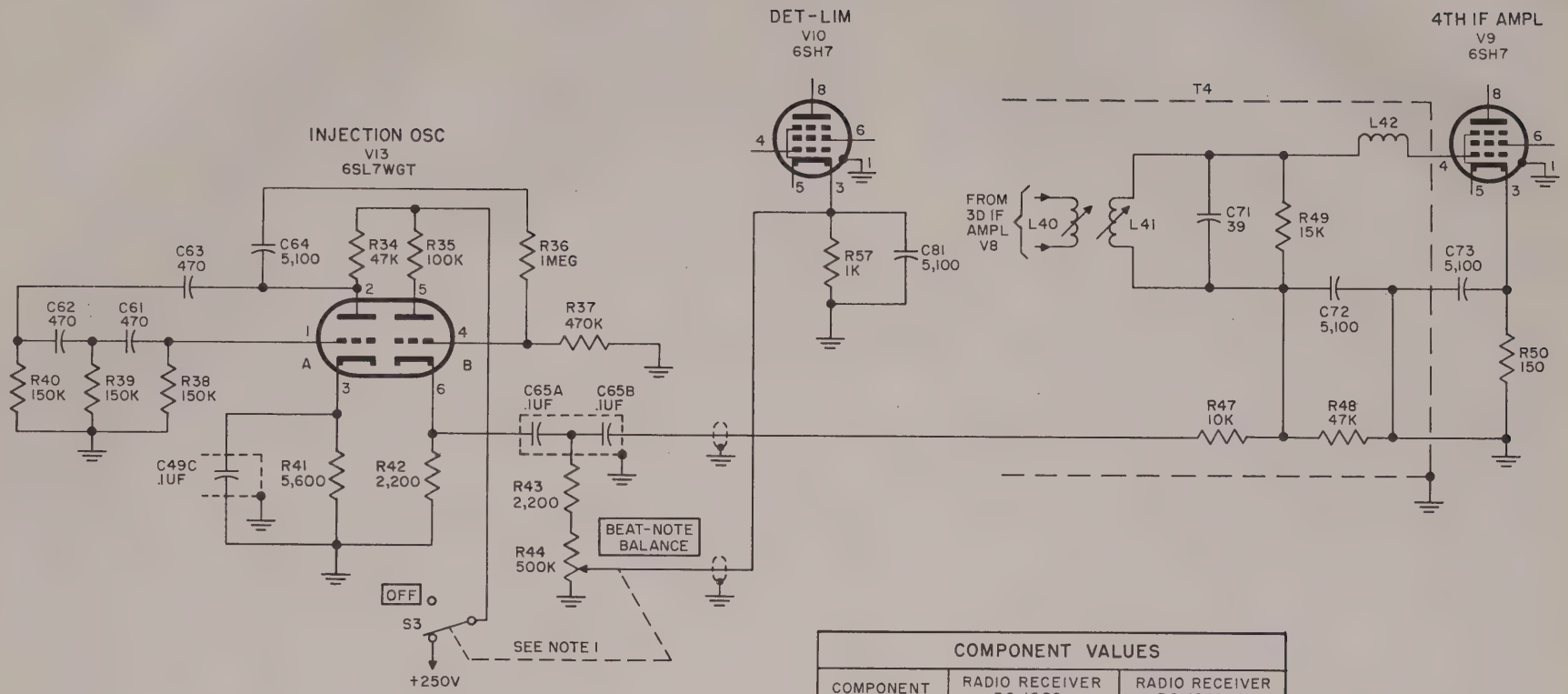
a. In a conventional low-frequency communications receiver, a beat-frequency oscillator is used for reception of cw signals. The beat-frequency oscillator is usually tuned to a frequency approximately plus or minus 1 kilocycle (kc) removed from the if. frequency. When this signal is combined with the received signal in the if. circuit, the two signals heterodyne and an audio note is produced.

b. Because of the high signal frequencies used in the receivers, such a system would be impractical without elaborate frequency-stabilizing devices for both the distant transmitter and the receiver local oscillator, to maintain the beat frequency within usable limits. An audio-frequency tone is generated in injection oscillator V13 and is used to grid-modulate the if. signal in the fourth if. stage V9. The injection oscillator is turned on only for cw reception. Plate voltage to the stage is applied when switch S3 on the BEAT–NOTE BALANCE control is closed.

c. Injection oscillator V13 uses a duotriode type 6SL7 tube in a phase-shift oscillator circuit. Section V13A functions as the phase-shift oscillator, while V13B functions as a buffer amplifier. To sustain oscillations, it is necessary to shift the output voltage 180° to obtain positive feedback. This is accomplished by the network composed of resistors and capacitors C63, R40; C62, R39; and C61, R38. Each "L" section shifts the phase angle 60° at approximately 1,000 cycles for a total of 180°. Cathode bias is furnished by the voltage drop across resistor R41, which is bypassed by capacitor C49C. Resistor R34 functions as the plate load.

d. The 1,000-cycle tone from the phase-shift oscillator is coupled through capacitor C64 and resistors R36 and R37, to the control grid (pin 4) of V13B. This half of the tube acts as a buffer amplifier to reduce the loading on the oscillator portion of the stage. The voltage across R37 is applied to the grid of V13B. Resistor R35 is the plate load resistor for the amplifier section.

e. The output of the buffer amplifier is taken from the cathode (pin 6) of V13B through capacitors C65A and C65B to a low impedance line, and the output appears across the voltage divider consisting of R47 and R48. The injection oscillator voltage appearing across R48 modulates the signal at the grid of the fourth if. amplifier.



NOTES:

1. WITH S3 IN OFF POSITION, ARM OF R44 IS GROUNDED.
2. COMPONENTS LISTED DIFFER IN VALUE FROM THOSE SHOWN IN PARTIAL SCHEMATIC DIAGRAM.

COMPONENT VALUES		
COMPONENT	RADIO RECEIVER BC-1269	RADIO RECEIVER BC-1269-A
C61	500	470
C62	500	470
C63	500	470
C64	5,000	4,700
V9	12SH7	
V10	12SH7	
V13	12SL7GT	

Figure 31. Injection oscillator circuit.

f. Because the injection oscillator modulates all voltages passing through fourth if. stage, V9, noise will be modulated as well as if. signals. After detection, a 1,000-cycle tone will be heard in the headset. To suppress this tone resulting from the modulation of noise, a portion of the injection oscillator output voltage is applied across resistor R57 in the cathode circuit (pin 3) of detector-limiter stage V10. This voltage is taken from the voltage divider formed by resistors R43 and R44 and is applied 180° out of phase with the unwanted tone produced by noise voltages. When BEAT-NOTE BALANCE control R44 is adjusted with no signal tuned in, the two voltages are made equal and the unwanted tone is canceled out. Switch S3, which is part of the variable resistor assembly, controls the application of power to the injection oscillator stage. It is set to OFF for fm or am reception. In Radio Receiver BC–1269, V13 is a tube type 12SL7.

64. First Af Amplifier

(fig. 32)

a. The first af amplifier stage, V15, uses a duotriode type 6SL7 tube. Only one triode section functions at a time. When MVC–AVC–FM switch S4 is in the MVC or AVC position, plate voltage is applied to V15A. Section V15B is inoperative because no plate voltage is applied. The audio signal developed in am detector stage V10 is applied across grid resistor R70 and impressed on the grid (pin 4) of V15A. Cathode bias is provided by the voltage drop across resistor R68. The amplified signal voltage developed across plate load resistor R69 is coupled through capacitor C96 to second af amplifier stage V16.

b. When MVC–AVC–FM switch S4 is in the FM position, plate voltage is applied to V15B, and V15A is inoperative. The audio signal developed in discriminator stage V11 is applied across grid resistor R73 and impressed on the grid (pin 1) of V15B. Cathode bias is provided by the voltage drop across resistor R67. The amplified signal voltage developed across plate load resistor R66 is coupled through blocking capacitor C95 to second af amplifier stage V16.

65. Second Af Amplifier

(fig. 32)

a. The output of the operating section of first af amplifier stage V15 is coupled to the tone control and volume control circuits in the grid circuit of second af amplifier V16, tube types 6SH7. The tone control circuit consists of capacitor C97 in series with variable resistor R71 and capacitor C98 in parallel with this combination. The TONE control provides maximum reduction of the high-frequency noise voltages when the arm of the control is nearest to capacitor C97. In this position, the impedance to ground for the higher audio frequencies and noise voltages is minimum and the shunting effect is greatest. The amplitude of the signal applied to the control grid (pin 4) is controlled by the setting of VOLUME control R72.

b. The plate and screen (pins 8 and 6) of the second af amplifier are tied together so that the stage operates as a triode. Cathode biasing resistor R74 is unbypassed to provide degeneration. The amplified output voltage appears across plate load resistor R65. Unwanted high-frequency noise voltages are shunted to ground by capacitor C99.

66. Output Stage

(fig. 32)

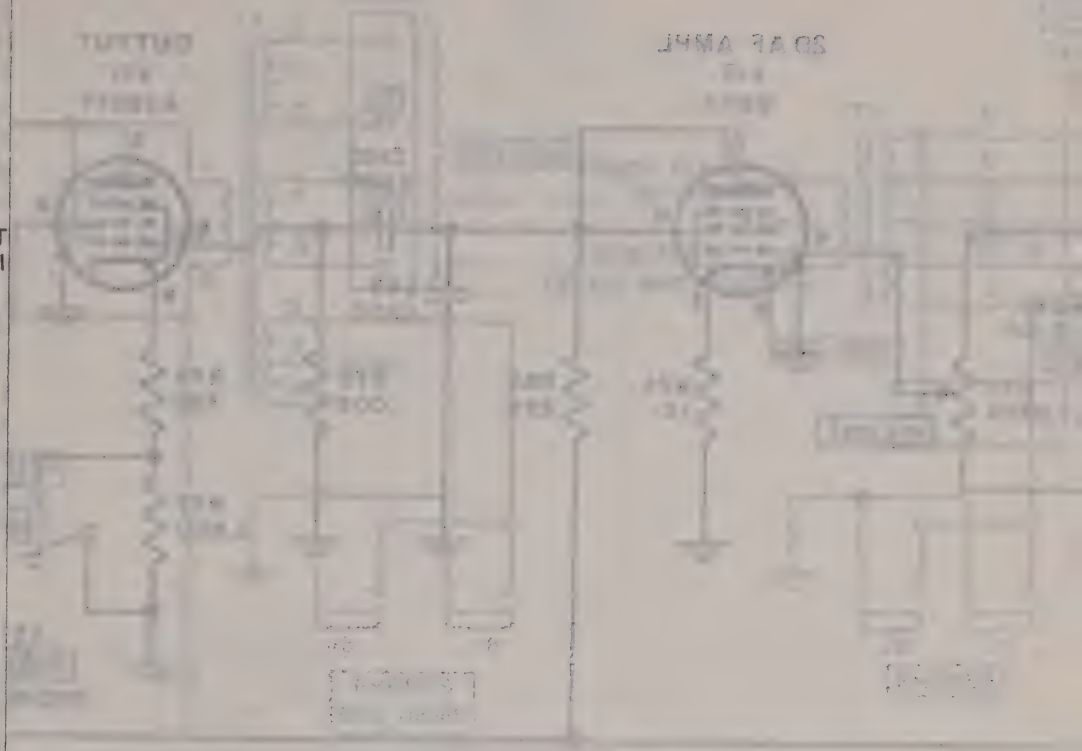
a. The output of second af amplifier stage V16 is coupled through capacitor C100 to the grid (pin 5) of audio output stage V17, which uses a type 6V6 tube. Resistor R75 is the grid return resistor for the output stage.

b. The power output from this stage is controlled by AUDIO HIGH-LOW switch S5. In the HIGH position switch S5 is closed and the tube receives its normal bias from the voltage drop across cathode resistor R76. In the low position, switch S5 is open and an additional resistor R77 is connected in the cathode circuit. The increased bias and degenerative action of the unbypassed cathode resistors cause the power output to decrease.

c. The output of audio stage V17 appears across the primary of output transformer T7 and is bypassed for unwanted high-frequency noise voltages by capacitor C101. The output transformer used with Radio Receivers BC–1269–A and R–593/GRR has three secondary windings. One has an impedance of 600 ohms. This winding is for headsets and is grounded on one side, it has a center tap which is not normally used. The other two windings are connected to the terminal strip at the rear of the receiver. When the two terminals marked CT are connected together, a 600-ohm line will be matched when connected across the two outer terminals.

INPUT
DISCRIMI
VI

INPUT
AM DET
VI



f. Because the injection oscillator modulates all voltages passing through fourth if. stage, V9, noise will be modulated as well as if. signals. After detection, a 1,000-cycle tone will be heard in the headset. To suppress this tone resulting from the modulation of noise, a portion of the injection oscillator output voltage is applied across resistor R57 in the cathode circuit (pin 3) of detector-limiter stage V10. This voltage is taken from the voltage divider formed by resistors R43 and R44 and is applied 180° out of phase with the unwanted tone produced by noise voltages. When BEAT-NOTE BALANCE control R44 is adjusted with no signal tuned in, the two voltages are made equal and the unwanted tone is canceled out. Switch S3, which is part of the variable resistor assembly, controls the application of power to the injection oscillator stage. It is set to OFF for fm or am reception. In Radio Receiver BC–1269, V13 is a tube type 12SL7.

64. First Af Amplifier

(fig. 32)

a. The first af amplifier stage, V15, uses a duotriode type 6SL7 tube. Only one triode section functions at a time. When MVC–AVC–FM switch S4 is in the MVC or AVC position, plate voltage is applied to V15A. Section V15B is inoperative because no plate voltage is applied. The audio signal developed in am detector stage V10 is applied across grid resistor R70 and impressed on the grid (pin 4) of V15A. Cathode bias is provided by the voltage drop across resistor R68. The amplified signal voltage developed across plate load resistor R69 is coupled through capacitor C96 to second af amplifier stage V16.

b. When MVC–AVC–FM switch S4 is in the FM position, plate voltage is applied to V15B, and V15A is inoperative. The audio signal developed in discriminator stage V11 is applied across grid resistor R73 and impressed on the grid (pin 1) of V15B. Cathode bias is provided by the voltage drop across resistor R67. The amplified signal voltage developed across plate load resistor R66 is coupled through blocking capacitor C95 to second af amplifier stage V16.

65. Second Af Amplifier

(fig. 32)

a. The output of the operating section of first af amplifier stage V15 is coupled to the tone control and volume control circuits in the grid circuit of second af amplifier V16, tube types 6SH7. The tone control circuit consists of capacitor C97 in series with variable resistor R71 and capacitor C98 in parallel with this combination. The TONE control provides maximum reduction of the high-frequency noise voltages when the arm of the control is nearest to capacitor C97. In this position, the impedance to ground for the higher audio frequencies and noise voltages is minimum and the shunting effect is greatest. The amplitude of the signal applied to the control grid (pin 4) is controlled by the setting of VOLUME control R72.

b. The plate and screen (pins 8 and 6) of the second af amplifier are tied together so that the stage operates as a triode. Cathode biasing resistor R74 is unbypassed to provide degeneration. The amplified output voltage appears across plate load resistor R65. Unwanted high-frequency noise voltages are shunted to ground by capacitor C99.

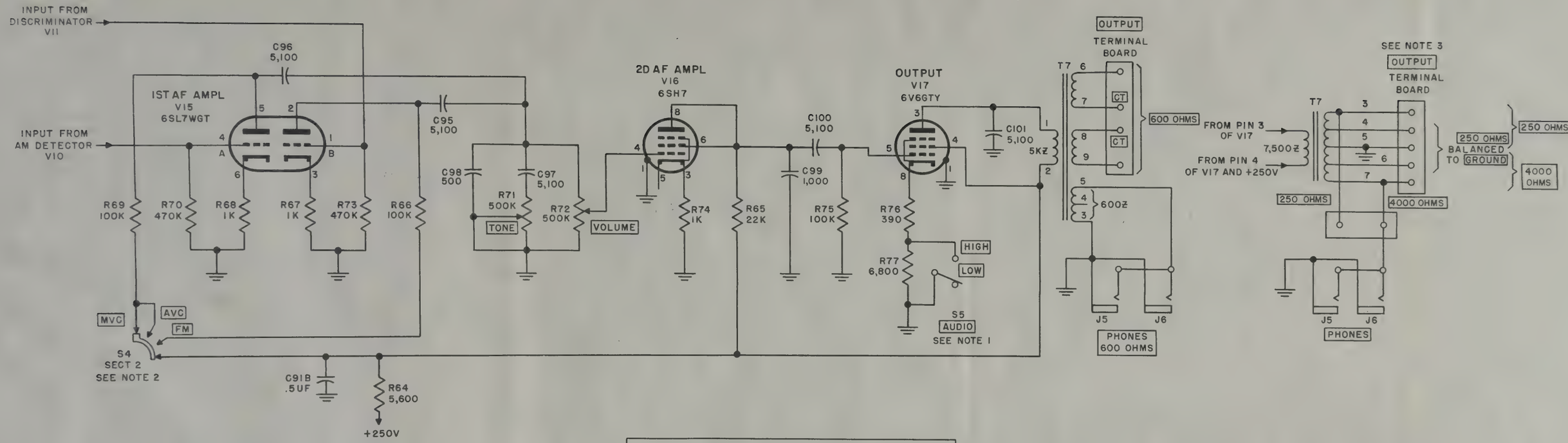
66. Output Stage

(fig. 32)

a. The output of second af amplifier stage V16 is coupled through capacitor C100 to the grid (pin 5) of audio output stage V17, which uses a type 6V6 tube. Resistor R75 is the grid return resistor for the output stage.

b. The power output from this stage is controlled by AUDIO HIGH-LOW switch S5. In the HIGH position switch S5 is closed and the tube receives its normal bias from the voltage drop across cathode resistor R76. In the low position, switch S5 is open and an additional resistor R77 is connected in the cathode circuit. The increased bias and degenerative action of the unbypassed cathode resistors cause the power output to decrease.

c. The output of audio stage V17 appears across the primary of output transformer T7 and is bypassed for unwanted high-frequency noise voltages by capacitor C101. The output transformer used with Radio Receivers BC–1269–A and R–593/GRR has three secondary windings. One has an impedance of 600 ohms. This winding is for headsets and is grounded on one side, it has a center tap which is not normally used. The other two windings are connected to the terminal strip at the rear of the receiver. When the two terminals marked CT are connected together, a 600-ohm line will be matched when connected across the two outer terminals.



NOTES:

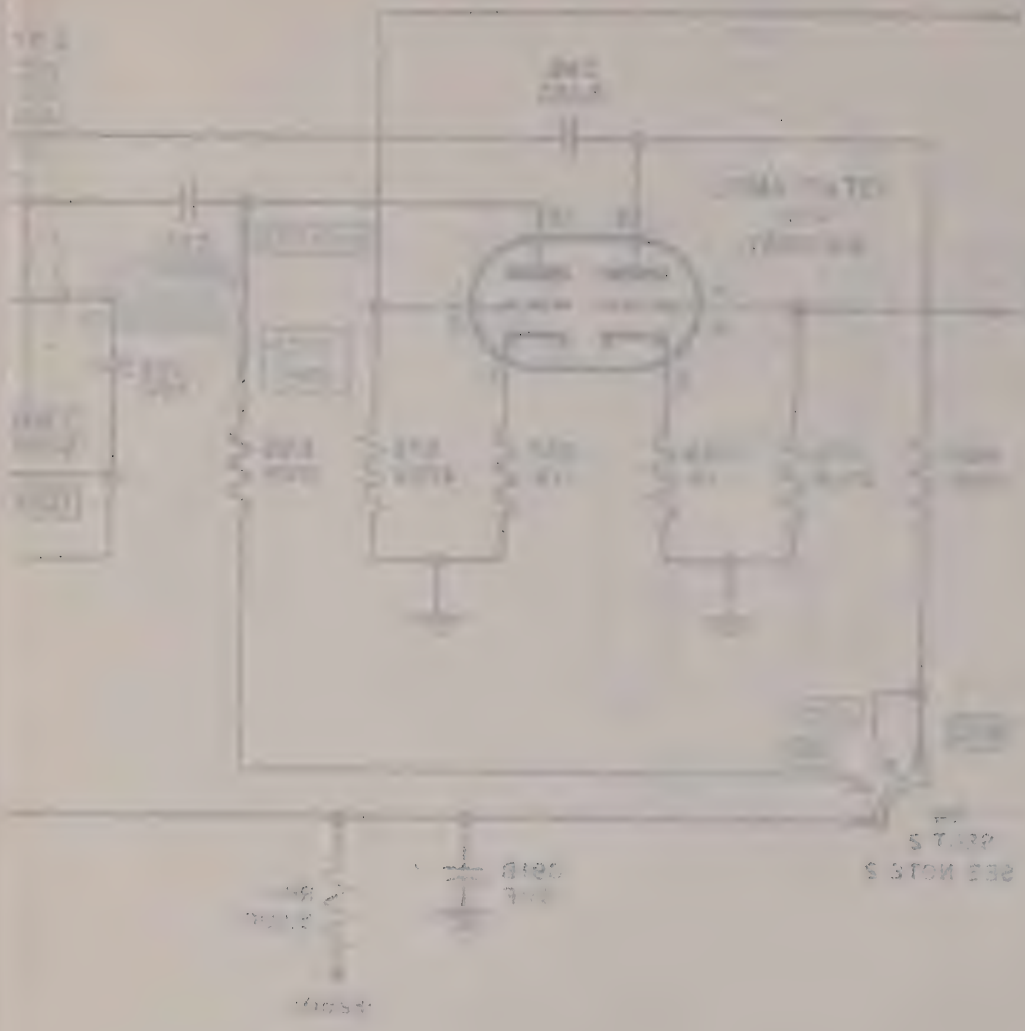
1. SWITCH S5 SHOWN IN LOW POSITION.
2. S4 VIEWED FROM END OPPOSITE KNOB AND IN MVC POSITION.
3. THIS OUTPUT TRANSFORMER USED WITH RADIO RECEIVER BC-1269.
4. COMPONENT VALUES LISTED DIFFER FROM THOSE SHOWN IN PARTIAL SCHEMATIC DIAGRAM.

COMPONENT VALUES		
COMPONENT	RADIO RECEIVER BC-1269	RADIO RECEIVER BC-1269-A
C95	5000	4700
C96	5000	4700
C97	5000	4700
C98		470
C100	5000	4700
C101	5000	4700
R65		47K
R76		470
V15	12SL7GT	
V16	12SH7	
V17	12A6Y	

SEE NOTE 4

Figure 32. Af amplifier circuits.

TM 260-91



d. The output transformer used with Radio Receiver BC–1269 has one secondary winding which is tapped for 250- and 4,000-ohm loads. The 250-ohm impedance may be connected either balanced or unbalanced to ground. A center tap is used as a common ground return for both impedance values. The 250- and 4,000-ohm taps are connected to a terminal board on the rear of the receiver for external audio systems and also to the PHONES jacks on the front panel through a terminal strip on the chassis. The lead from the PHONES jacks may be connected to either the 250 OHMS or the 4000 OHMS tap on the terminal board on the chassis.

e. Plate decoupling is provided by resistor R64 and capacitor C91B. This decoupling network is common to the plate return circuits in the first and second af amplifier stages and in the af output stage. Radio Receiver BC–1269 uses tube types 12SL7, 12SH7, and 12A6 as the first and second af amplifiers and output stage.

67. Filament Circuits

(fig. 45)

a. Radio Receivers R–593/GRR and BC–1269–A. The filament circuits for these two receivers are practically the same because of the similarity of tubes. The filament power for all three receivers is supplied by Power Supply Unit RA–61–A. The 6.3-volt filament voltage is applied to the receivers on pins B and E of jack J3. The filaments are all in parallel since they all require 6.3-volts with the exception of V1, tube type 9005. Series-connected resistor R1, 18 ohms, drops the voltage to 3.6 volts for this one stage. Low-pass filters, such as coil L24, capacitors C14 and C18, and similarly coil L15 and capacitors C10 and C16, prevent rf currents from circulating in the filament circuits.

b. Radio Receiver BC–1269. This receiver requires a 12.6-volt filament supply. The filament voltage is applied to the receiver on pins B and E of jack J3. All of the tubes have 12.6-volt filaments with the exception of V3 and V4, tube type 7G8, and V1 and V2, tube types 9005 and 955 respectively. Tubes V3 and V4 require 6.3 volts and are connected in series across the 12.6 volts to accomplish this. Tubes V1 and V2 and resistor R1, 18 ohms, are connected in series across the 12.6 volts to obtain the proper filament voltage. The voltage divides as follows: 6.3 volts across V2, 2.7 volts across R1, and 3.6 volts across V1. The filtering action of the rf chokes and capacitors prevents rf currents from flowing in the filament circuits.

68. Power Supply Unit RA–61–A

(fig. 33)

a. Power Supply Unit RA–61–A is a single-tube, full-wave rectifier used to supply plate, screen, and filament voltages to the *receiver*. The 60-cycle input voltage is applied to transformer T201 by means of Cord CD–873. Switch S201 can be set for operation from either a 115- or 230-volt ac source. When operating from a 230-volt source, fuse F201 is used; for 115-volt operation, fuse F202 is used. Transformer T201 has an electrostatic shield which prevents rf voltages from being fed through the transformer. The application of power to transformer T201 is controlled from the receiver. Connections to POWER switch S2 in the *receiver* are made through pins C and D of plug J201. Unwanted noise voltages which may be present in the voltage source are filtered out by capacitors C201 and C202.

b. Transformer T201 has four secondary windings to provide the necessary outputs. One winding supplies 5 volts ac to the filament of full-wave rectifier V201, which uses a type 5U4 tube. A second winding supplies high ac voltage to the rectifier plates. This voltage is rectified and then filtered by capacitors C203, C204, and C205, and coils L201 and L202. The third and fourth windings supply 6.3 volts each for the receiver filaments. Depending on the filament voltage requirements (par. 8) of the receiver in use, switch S202 connects the two filament windings in parallel for 6.3-volt filament operation, or in series for 12.6-volt operation. The ac filament voltage and filtered dc output voltage are supplied to the receiver through Cord CD–872 and Connector J201.

Caution: Before connecting Power Supply Unit RA–61–A to the *receiver*, be sure that switch S201 is set to the proper line-voltage position. Also be sure that switch S202 is set to provide the correct filament voltage for the receiver in use (par. 8).

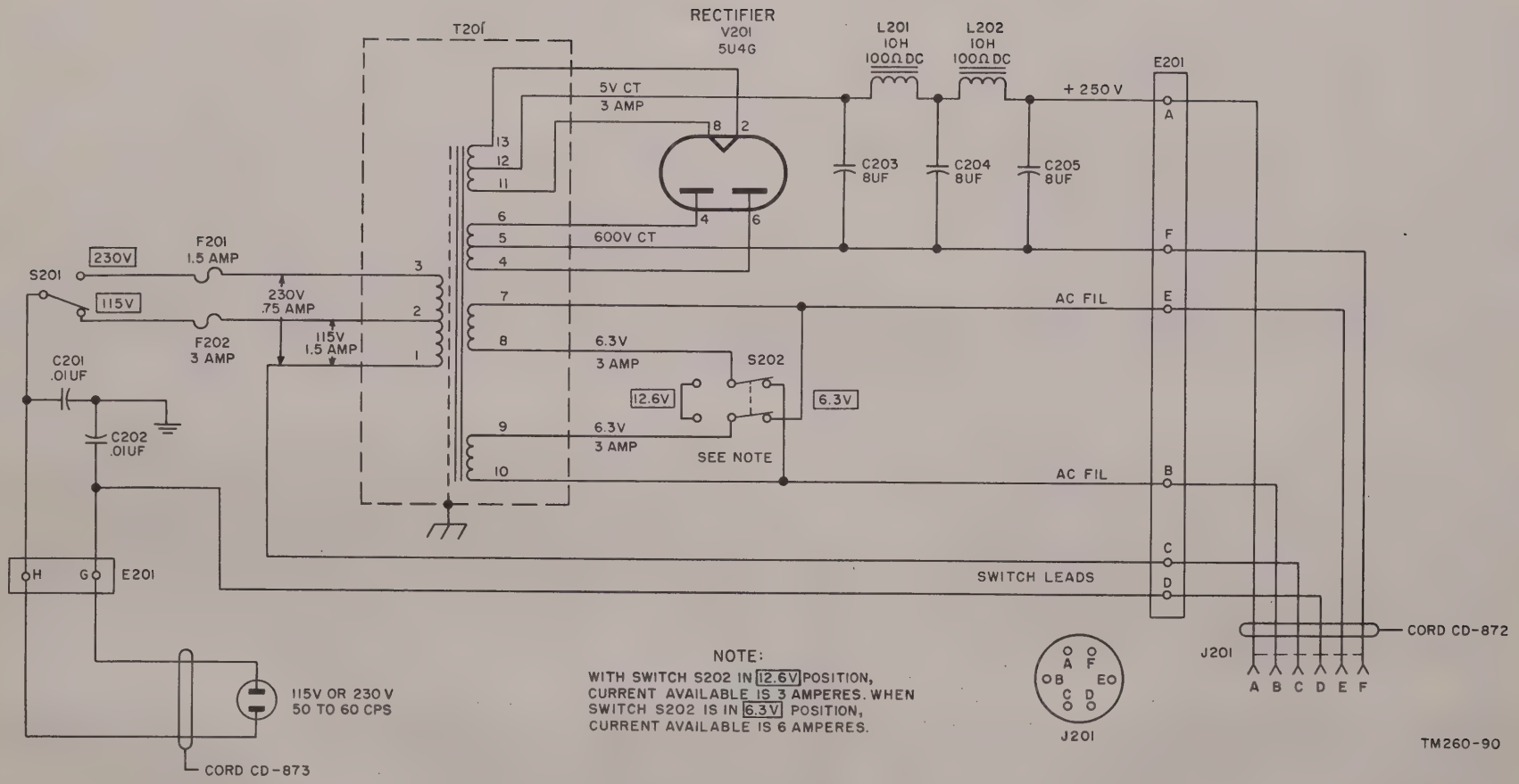


Figure 33. Power Supply Unit RA-61-A circuit.

CHAPTER 5

FIELD MAINTENANCE

Note. This chapter contains information for field maintenance. The amount of repair that can be performed by units having field maintenance responsibility is limited only by the tools and test equipment available, and by the skill of the repairman.

Section I. TROUBLESHOOTING AT FIELD MAINTENANCE LEVEL

69. Extent of Instructions

Troubleshooting at a field maintenance level includes all the techniques outlined for organizational maintenance (pars. 36–46) and any other techniques that may be required to isolate a defective part. The field maintenance instructions supplement the instructions described in paragraphs 36 through 46. The systematic troubleshooting procedure, which begins with the operational and sectionalization checks that can be performed at an organizational level (par. 46), must be completed by means of sectionalizing, localizing, and isolating techniques described in paragraphs 70 through 79.

Warning: When servicing Radio Set SCR–616 be extremely careful because of the high voltages exposed in the power supply unit and the receiver. Keep one hand in pocket when measuring socket voltages with the probe. Before touching any part after the voltage is shut off, short the part to the chassis.

70. Troubleshooting Procedures

The first step in servicing a defective radio set is to sectionalize the fault. Sectionalization means tracing the fault to the major component or circuit responsible for the abnormal operation of the set. The second step is to localize the fault. Localization means tracing the fault to the defective *part* responsible for the abnormal condition. Some faults, such as burned-out resistors and shorted transformers, can often be located by sight, smell, and hearing. The majority of faults, however, must be localized by checking voltage and resistance.

a. System Sectionalization. System sectionalization is discussed in paragraph 43.

b. Component Sectionalization and Localization. The tests listed below aid in isolating the source of trouble. To be effective, the procedure should be followed in the order given. First, trouble in the receiver should be localized to a single stage or circuit. Then the trouble may be isolated within that stage or circuit by appropriate voltage, resistance, and continuity measurements. The service procedure is summarized as follows:

(1) *Visual inspection.* The purpose of visual inspection (par. 44) is to locate any visible trouble. Through this inspection alone, the repairman may frequently discover the trouble, or determine the stage in which the trouble exists. This inspection is valuable in avoiding additional damage to the radio set which might occur through improper servicing methods and in forestalling future failures.

(2) *Input resistance measurements.* These measurements (par. 74) prevent further damage to the receiver from possible short circuits. Since this test gives an indication of the condition of the filter circuits, its function is more than preventive.

(3) *Operational test.* The operational test (par. 75) is important because it frequently indicates the general location of trouble. In many instances, the information gained will determine the exact nature of the fault. To use this information fully, all symptoms must be interpreted in relation to one another.

(4) *Troubleshooting chart.* The trouble symptoms listed in this chart (par. 76) will aid greatly in localizing trouble.

(5) *Signal substitution.* The principal advantage of the signal substitution method (par. 78) is that it usually enables the

repairman to localize a trouble accurately and quickly to a given stage when the general location of the trouble is not immediately evident from the above tests.

(6) *Stage gain charts.* These charts (par. 79) can be used to localize obscure, hard-to-find troubles.

(7) *Intermittents.* In all these tests, the possibility of intermittents should not be overlooked. If present, this type of trouble often may be made to appear by tapping or jarring the power supply unit or the receiver.

71. Troubleshooting Data

Take advantage of the material supplied in this manual. It will help in the rapid location of faults. Consult the following troubleshooting data:

a. Radio Receiver.

Figure	Paragraph	Title
13		Receiver, front panel.
	46	Equipment performance check list.
23		High-frequency oscillator and mixer sections.
	74	Checking key circuits for shorts.
	72	Test equipment required for trouble-shooting.
	76	Troubleshooting chart.
34		Radio Receiver R–593/GRR, tube-socket voltage and resistance chart.
35		Radio Receiver BC–1269, tube-socket voltage and resistance chart.
36		Radio Receiver BC–1269–A, tube-socket voltage and resistance diagram.
37		Location of terminal boards in Radio Receiver R–593/GRR.
	79	Stage gain chart.
39		Radio Receivers BC–1269, BC–1269–A and R–593/GRR, tube location.
40		Radio Receivers BC–1269 and R–593/-GRR, alinement points.
41		Radio Receiver BC–1269–A, alinement points.
42		Radio Receiver R–593/GRR, bottom view.
43		MIL–STD resistor color codes.
44		MIL–STD capacitor color codes.
45		Receiver filament circuit.
46		Radio Receiver BC–1269, schematic diagram.
47		Radio Receiver BC–1269–A, schematic diagram.
48		Radio Receiver R–593/GRR, schematic diagram.

b. Power Supply Unit.

Figure	Paragraph	Title
10		Power Supply Unit RA–61–A, rear view with doors open.
33		Power Supply Unit RA–61–A circuit.
38		Power Supply Unit RA–61–A, removed from case.
	68	Power Supply Unit RA–61–A.

72. Test Equipment and Tools Required for Troubleshooting

The test equipment and tools required for troubleshooting Radio Set SCR–616 are listed below.

Nomenclature	Common name	Technical manual
Tool Equipment TE–113	Tool equipment	
Moisture and Fungus Proofing Equipment MK–2/GSM		
Multimeter TS–352/U	Multimeter	TM 11–5527
Electron Tube Test Set TV–2/U	Tube tester	TM 11–2661
Electronic Multimeter TS–505/U	Vtvm	TM 11–5511
Signal Generator TS–497A/URR	Signal generator	TM 11–5030
Signal Generator AN/URM–49	Signal generator	
Signal Generator AN/URM–70	Signal generator	
Frequency Meter AN/URM–80	Frequency meter	
Frequency Meter TS–186A/UP	Frequency meter	
Spectrum Analyzer TS–723/U	Spectrum analyzer	
Audio Oscillator TS–382A/U	Signal generator	TM 11–2684A
Headset HS–30–(*)		
Electrical Headset H–113/U		
Resistor, 600-ohm, 2-watt		
Resistor, 250-ohm, 2-watt		

73. General Troubleshooting Information

a. A visual examination of each glass tube will show whether or not the heater is lighted.

b. After the receiver has been operated for a few minutes, the metal tubes will be warm if their heaters are lit.

c. Mechanical failure of MVC–AVC–FM switch S4 and FREQUENCY BAND switch S1 can sometimes be located by rotating the switch.

d. The sense of smell can be used in directly locating an overheated component or burning insulation.

e. In the majority of cases, a vacuum tube will be at fault. Be careful when replacing a burned-out tube with the spare, especially the rectifier tube in Power Supply Unit RA–61–A. Make the tests in paragraph 74.

f. When a part has been replaced in an if. circuit, check the sensitivity of the receiver (par. 92). If the sensitivity is below normal, realinement of the if. amplifiers is necessary (par. 87). As a field expedient, the if. transformer in the repaired stage can be adjusted by peaking the noise level, rather than realining the entire if. system.

g. When a part is replaced in the rf or if. circuits, place it exactly as the original one was placed. A part which has the same electrical value but different physical size may cause trouble in high-frequency circuits. Give particular attention to proper grounding when replacing a part. Use the same ground as in the original wiring. Failure to observe these precautions may result in decreased gain or possibly in oscillation of the circuit.

h. Do not use a large soldering iron when soldering small resistors or ceramic capacitors. Overheating of small parts may ruin or change the value of the component.

i. Do not disturb any of the alinement adjustments unless it has been definitely determined that the trouble is caused by misalinement.

74. Checking Key Circuits for Shorts

Trouble within the receiver may often be detected by checking the resistance of the filament and high-voltage circuits before applying power to the equipment, thereby preventing damage to the power supply. To make the following checks, leave Power Supply Unit RA–61–A disconnected.

a. Set FREQUENCY BAND switch S1 to 145–300 MC. Set the BEAT-NOTE BALANCE control approximately at midposition. Turn MVC–AVC–FM switch S4 to FM. Set POWER switch S2 to ON. The resistance between terminals A and F on POWER connector J3 (figs. 11 and 12) should be 35,000 ohms.

b. Turn MVC–AVC–FM switch S4 to AVC. Set FREQUENCY BAND switch S1 to 300–600 MC. The resistance measured between terminals A and F of J3 should be 56,000 ohms.

c. With the controls set as in *b* above, the resistance measured from the anode (pin 5) of V12 to ground should be approximately 54,000 ohms. Set FREQUENCY BAND switch S1 to 145–300 MC. Approximately 54,000 ohms should again be indicated.

d. With all tubes and dial lamps removed, the heater circuit resistance measured between terminals B and E of connector J3 should read infinite (FREQUENCY BAND switch in either position). If any resistance is indicated in this circuit, make a visual inspection of the wiring, and the physical position of filament rf chokes, which may be shorting to structural or supporting portions of the chassis. Check the filament bypass capacitors for a possible short circuit. Refer to the receiver schematic diagram (figs. 46–48).

e. Measure the resistance between pins A and F on connector J201 of Power Supply Unit RA–61–A. Reverse the ohmmeter test leads if necessary to provide a reading which shows the charging of the electrolytic capacitors in the power supply. The resistance measured should be infinite (open circuit). A low reading indicates a shorted filter capacitor or filter choke. Do not apply power if the resistance reading is low, because the rectifier tube may become damaged.

75. Operational Test

Check to see that all knobs, switches, and controls are tight and properly indexed. Pilot lamps and fuses should be of the proper size. With the receiver connected to its associated components in the radio set, follow the starting procedure outlined in paragraph 24 and apply power by turning POWER switch S2 to the ON position. The receiver is designed for three general types of reception: am, fm, and cw (par. 25). Procedures for determining satisfactory operation of the receiver are given below.

a. Set the receiver for am reception by turning the MVC–AVC–FM switch S4 to AVC. Set FREQUENCY BAND switch S1 to 45–300 MC and BEAT-NOTE BALANCE control R44 to OFF. Rotate VOLUME control R72 until a smooth rushing noise is heard in the headset. No

crackling or erratic noise should be heard while turning the volume control. Rotate the TUNING control; the dial should turn noiselessly with no slipping or backlash. When tuning from a weak signal to a strong one, the avc action should prevent the strong signal from blasting in or severely distorting. Operating SENSITIVITY control R27 should provide smooth attenuation of noise and signals. Repeat the tests for the 300- to 600-mc band.

b. To check cw operation of the receiver, set MVC–AVC–FM switch S4 to MVC. Turn BEAT-NOTE BALANCE control R44 clockwise; a 1,000-cycle tone modulation of the noise background should be heard in the headset; adjustment of the balance control should cause the noise modulation to null. Movement of the control should be noiseless and smooth. When cw signals are received, a distinct 1,000-cycle tone should be heard. Repeat these tests for the 300- to 600-mc band.

c. To check fm operation of the receiver, place MVC–AVC–FM switch S4 to FM. Set the BEAT-NOTE BALANCE control to OFF. Background noise should be heard in the headset in the absence of any signals. Received signals should be free from obvious distortion not originating at the source.

76. Troubleshooting Chart

The following chart is supplied as an aid in locating trouble in the receiver and associated power supply unit. This chart lists the symptoms which the repairman observes, either visually or audibly, while making a few simple tests. The chart also indicates how to localize trouble quickly to the audio, if. or rf section of the receiver. The signal substitution tests described in paragraph 78 can then be used to supplement this procedure and to determine the defective stage. Stage gain information is given in paragraph 79. Once the trouble has been localized to a stage or circuit, a tube check and voltage and resistance measurements of this stage or circuit should ordinarily be sufficient to isolate the defective part. Normal voltage and resistance measurements are given in figures 34, 35, and 36. The location of terminal boards and their component parts for Radio Receiver R–593/GRR are shown in figure 37. Figure 42 is an underside view of the R–593/GRR chassis, showing parts location. A view of the power supply chassis components is shown in figure 38.

Symptom	Probable trouble	Correction
1. Receiver dead	*a.* Defective fuse F202 or F201 in Power Supply Unit RA–61–A.	*a.* Replace defective fuse. If fuses blow repeatedly, proceed with items *d* and *e* below.
	b. Headset poorly connected to receiver.	*b.* Plug headset into PHONES jack properly.
	c. Defective headset	*c.* Replace defective headset.
	d. B+ short in receiver	*d.* Test key circuits for shorts (par. 74). Check capacitors C49B, C50, C60B, C60C, and C101 for short circuit.
	e. B+ short in power supply	*e.* Check capacitors C203, C204, and C205, and choke coils L201 and L202 for short circuit. Check for shorted rectifier tube V201.
	f. Defective or burned-out tube	*f.* Replace tube.
	g. Defective cord from power supply unit to ac power source.	*g.* Repair Cord CD–873 if possible; replace cord if necessary.
	h. Defective cord from power unit to receiver.	*h.* Repair Cord CD–872 if possible; replace if necessary.
2. Weak reception on all positions of MVC–AVC–FM switch.	*a.* Defective antenna	*a.* Disconnect the antenna in use at the rear of the receiver, and insert the antenna connector for the other frequency band. If reception is nearly normal, repair faulty condition in the antenna for the weak channel.
	b. Defective stage in rf section	*b.* Set FREQUENCY BAND switch to other range. If output becomes normal, the trouble is isolated to the rf section switched out. Proceed with items 3 and 4 below.
	c. Defective Headset HS–30–(*) or Electrical Headset H–113/U.	*c.* Replace headset.

Symptom	Probable trouble	Correction
	d. Defective tube	*d.* Check tubes for good emission.
	e. Low B+ voltage	*e.* Check ac line voltage. Check voltage regulator tube V12.
	f. Improper grid bias	*f.* Check for defective cathode resistors and shorted bypass capacitors in the if. amplifier circuits. Use the voltage resistance charts (figs. 34, 35, and 36).
	g. Defective stage	*g.* Check stage gain (par. 79). Check for defective component in weak stages.
	h. Receiver alinement	*h.* Realine receiver (par. 86).
3. Weak reception on the low-frequency band (145–300 MC). Antenna checks good.	*a.* Defective rf amplifier, lf. oscillator, or lf. mixer tube.	*a.* Check tubes. Replace those found to be defective.
	b. Defective antenna connector J2	*b.* Repair or replace connector.
	c. Defective FREQUENCY BAND switch S1.	*c.* Repair or replace bandswitch.
	d. Defective component in the low-frequency band rf section.	*d.* Check voltages and resistance (figs. 34–36). Replace defective component.
4. Weak reception on the high-frequency band (300–600 MC). Antenna checks good.	*a.* Defective hf mixer or hf oscillator tube.	*a.* Check tubes. Replace those found to be defective.
	b. Defective antenna connector J1.	*b.* Repair or replace connector.
	c. Defective FREQUENCY BAND switch S1.	*c.* Repair or replace bandswitch.
	d. Defective component in the high frequency band rf section.	*d.* Check voltages and resistance (figs. 34, 35, and 36). Replace defective component.
5. Weak reception on AVC and MVC; FM reception normal.	*a.* One half of first af amplifier tube defective.	*a.* Replace defective tube.
	b. Defective MVC–AVC–FM switch.	*b.* Repair or replace switch.
6. Weak reception on FM; AVC and MVC reception normal.	*a.* Defective discriminator tube or circuit.	*a.* Replace defective tube or check circuit.
	b. One half of first af amplifier tube or circuit defective.	*b.* Replace defective tube or check circuit.
	c Defective MVC–AVC–FM switch S4.	*c.* Repair or replace switch.
7. No tone when receiving cw signals; BEAT-NOTE BALANCE control turned on.	*a.* Defective injection oscillator tube	*a.* Replace defective tube.
	b. Defective component in injection oscillator circuit.	*b.* Check voltages and resistances (figs. 34, 35, and 36). Replace defective component.
8. Motorboating	*a.* Open avc bypass capacitor C48	*a.* Replace defective component.
	b. Open grid connection	*b.* Check resistance of each grid circuit (figs. 34, 35, and 36). Replace defective component.
9. Objectionable 120-cycle hum in output.	*a.* Shorted or open filter capacitor 203, 204, or 205 in power supply.	*a.* Replace defective component.
	b. Shorted turns in choke coil L201 or L202.	*b.* Measure resistance of choke coils L201 and L202 (par. 77). Replace defective component.
10. Objectionable 60-cycle hum in output.	*a.* Heater-to-cathode leakage in audio tube V15, V16, or V17.	*a.* Test tubes for leakage or replace suspected tube with one known to be good.
	b. One half of rectifier V201 in power supply shorted or open.	*b.* Replace defective tube.
11. Receiver noise	*a.* Insufficient input signal	*a.* Check position of antenna with respect to direction and polarization of received signal.
	b. Defective tube	*b.* Check tubes. Replace those found to be defective.
	c. Near-by electrical interference	*c.* Change location, or suppress the noise at its source.
	d. Open capacitor C201 or C202 in the power supply unit.	*d.* Replace defective capacitor.

Symptom	Probable trouble	Correction
12. Distortion in output	*a.* Defective audio tube	*a.* Replace defective tube.
	b. Improper grid bias	*b.* Check for leaky audio coupling capacitor C100, C95, or C96. Check for shorted audio bypass capacitor C97, C98, or C99.
13. Intermittent noise or microphonics.	Defective tube or component	With an insulated prod, gently tap and slightly move all accessible tubes, resistors, capacitors, and soldered connections to locate loose elements in tubes or faulty connections to any component. Replace suspicious part.

77. Dc Resistances of Transformers and Coils

The dc resistances of transformers, windings, and coils are given below.

a. Radio Receiver R–593/GRR and BC–1269–A.

Component	Terminals	Ohms
Transformer T7	1–2	95
	3–4	10
	4–5	10
	6–7	11
	8–9	11

b. Radio Receiver BC–1269.

Component	Terminals	Ohms
Transformer T7	1–2	
	3–4	4. 5
	4–5	4. 9
	5–6	5. 6
	6–7	158

c. Power Supply Unit RA–61–A.

Component	Terminals	Ohms
Transformer T201	1–2	2. 36
	1–3	5. 18
	4–5	53. 0
	5–6	56. 0
	7–8	. 1
	9–10	. 1
	11–12	. 06
	12–13	. 06
Coil L201		100
Coil L202		100

78. Signal Substitution

a. General.

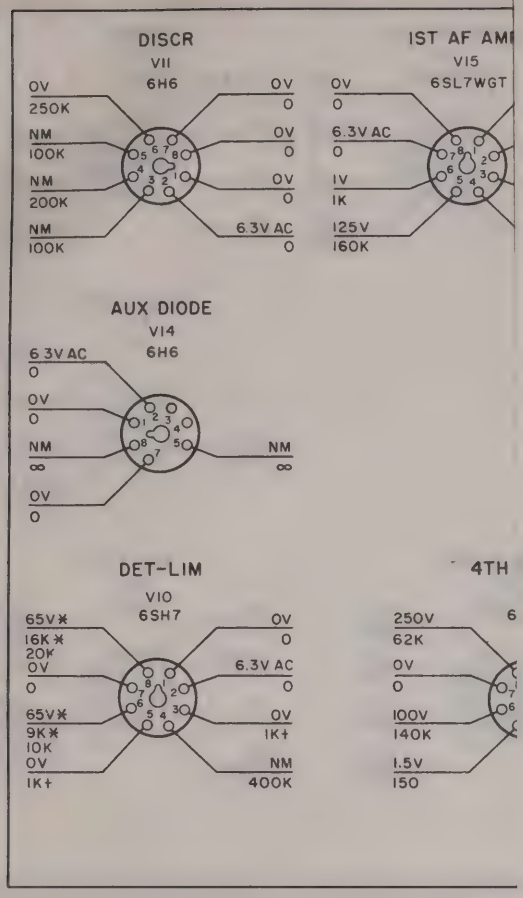
(1) Signal substitution requires a source of af, if., and rf signals. Rf signal generators, such as TS–497A/URR, AN/URM–70 and AN/URM–49, and Audio Oscillator TS–382A/U, are suitable for this purpose.

(2) In addition, a headset, such as Headset HS–30–(*) or the H–113/U (par. 12), or a permanent magnet loudspeaker, such as Loudspeaker LS–3, is necessary.

(3) A multimeter, such as Multimeter TS–352/U and a tube tester such as Electron Tube Test Set TV–2/U are also needed to isolate the defective part after the faulty stage has been located by signal substitution.

(4) The following tests are designed to locate the defective stage in an inoperative receiver: A substitute signal from a signal generator is introduced into the circuit under test. The test is started at the output audio amplifier stage and continued through the receiver to the antenna input connectors. When the test signal is applied to a stage that does not produce a normal output signal, that stage is the defective one.

(5) Note the volume, and listen for serious distortion from the loudspeaker or headset at the various points in the signal substitution procedure. When working back from the output to the input stages, decrease the output of the signal generator as much as possible. If possible, compare the output with that of a receiver known to be in good condition.



NOTES:

1. LINE VOLTAGE 115V AC.
2. VOLTAGE READINGS ABOVE LINE, RESISTANCE READING BELOW LINE.
3. VOLTAGES AND RESISTANCES MEASURED TO GROUND WI 20,000-OHMS-PER-VOLT METER.
4. VOLTAGES ARE DC POSITIVE WITH RESPECT TO GROUNI UNLESS OTHERWISE INDICATED.

Symptom	Probable trouble	Correction
12. Distortion in output	*a.* Defective audio tube	*a.* Replace defective tube.
	b. Improper grid bias	*b.* Check for leaky audio coupling capacitor C100, C95, or C96. Check for shorted audio bypass capacitor C97, C98, or C99.
13. Intermittent noise or microphonics.	Defective tube or component	With an insulated prod, gently tap and slightly move all accessible tubes, resistors, capacitors, and soldered connections to locate loose elements in tubes or faulty connections to any component. Replace suspicious part.

77. Dc Resistances of Transformers and Coils

The dc resistances of transformers, windings, and coils are given below.

a. Radio Receiver R–593/GRR and BC–1269–A.

Component	Terminals	Ohms
Transformer T7	1–2	95
	3–4	10
	4–5	10
	6–7	11
	8–9	11

b. Radio Receiver BC–1269.

Component	Terminals	Ohms
Transformer T7	1–2	
	3–4	4. 5
	4–5	4. 9
	5–6	5. 6
	6–7	158

c. Power Supply Unit RA–61–A.

Component	Terminals	Ohms
Transformer T201	1–2	2. 36
	1–3	5. 18
	4–5	53. 0
	5–6	56. 0
	7–8	. 1
	9–10	. 1
	11–12	. 06
	12–13	. 06
Coil L201		100
Coil L202		100

78. Signal Substitution

a. General.

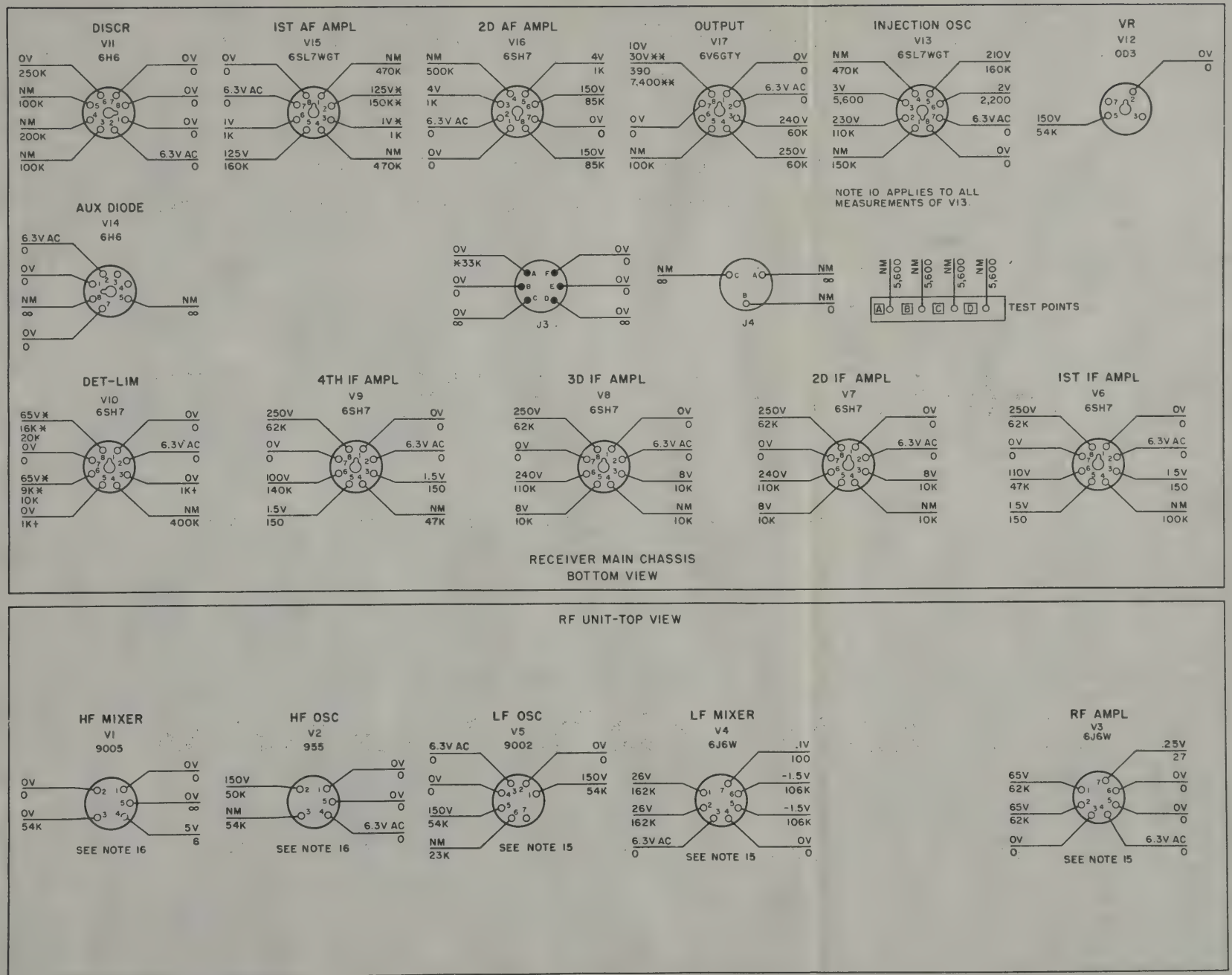
(1) Signal substitution requires a source of af, if., and rf signals. Rf signal generators, such as TS–497A/URR, AN/URM–70 and AN/URM–49, and Audio Oscillator TS–382A/U, are suitable for this purpose.

(2) In addition, a headset, such as Headset HS–30–(*) or the H–113/U (par. 12), or a permanent magnet loudspeaker, such as Loudspeaker LS–3, is necessary.

(3) A multimeter, such as Multimeter TS–352/U and a tube tester such as Electron Tube Test Set TV–2/U are also needed to isolate the defective part after the faulty stage has been located by signal substitution.

(4) The following tests are designed to locate the defective stage in an inoperative receiver: A substitute signal from a signal generator is introduced into the circuit under test. The test is started at the output audio amplifier stage and continued through the receiver to the antenna input connectors. When the test signal is applied to a stage that does not produce a normal output signal, that stage is the defective one.

(5) Note the volume, and listen for serious distortion from the loudspeaker or headset at the various points in the signal substitution procedure. When working back from the output to the input stages, decrease the output of the signal generator as much as possible. If possible, compare the output with that of a receiver known to be in good condition.



NOTES:

1. LINE VOLTAGE 115V AC.
2. VOLTAGE READINGS ABOVE LINE, RESISTANCE READINGS BELOW LINE.
3. VOLTAGES AND RESISTANCES MEASURED TO GROUND WITH 20,000-OHMS-PER-VOLT METER.
4. VOLTAGES ARE DC POSITIVE WITH RESPECT TO GROUND UNLESS OTHERWISE INDICATED.
5. MVC AVC FM SWITCH AT MVC.
6. * INDICATES MVC AVC FM SWITCH AT FM.
7. SENSITIVITY CONTROL MINIMUM.
8. VOLUME CONTROL MAXIMUM.
9. BEAT-NOTE BALANCE CONTROL AT OFF.
10. † INDICATES BEAT-NOTE BALANCE CONTROL NOT AT OFF.
11. AUDIO SWITCH AT HIGH.
12. ** INDICATES AUDIO SWITCH AT LOW.
13. NM INDICATES NOT MEASURED.
14. ∞ INDICATES INFINITY (OPEN CIRCUIT).
15. SWITCH S1 IN 145-300 MC POSITION FOR THESE READINGS
16. SWITCH S1 IN 300-600 MC POSITION FOR THESE READINGS

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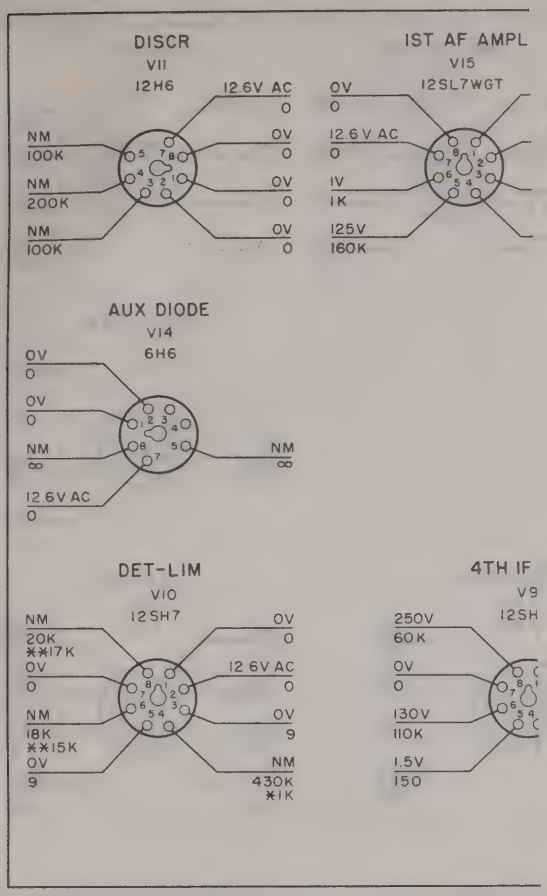
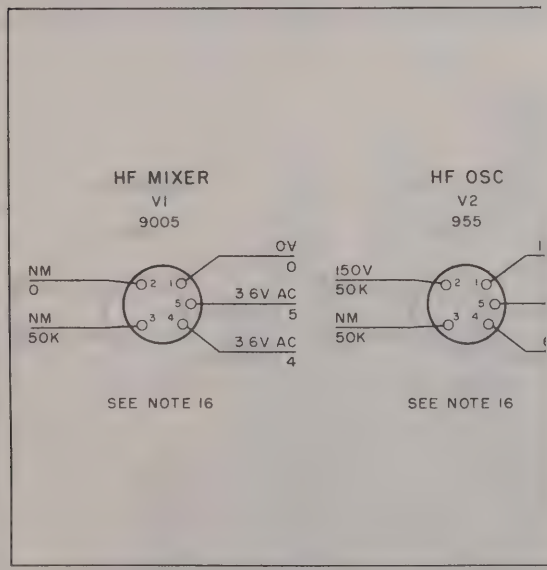
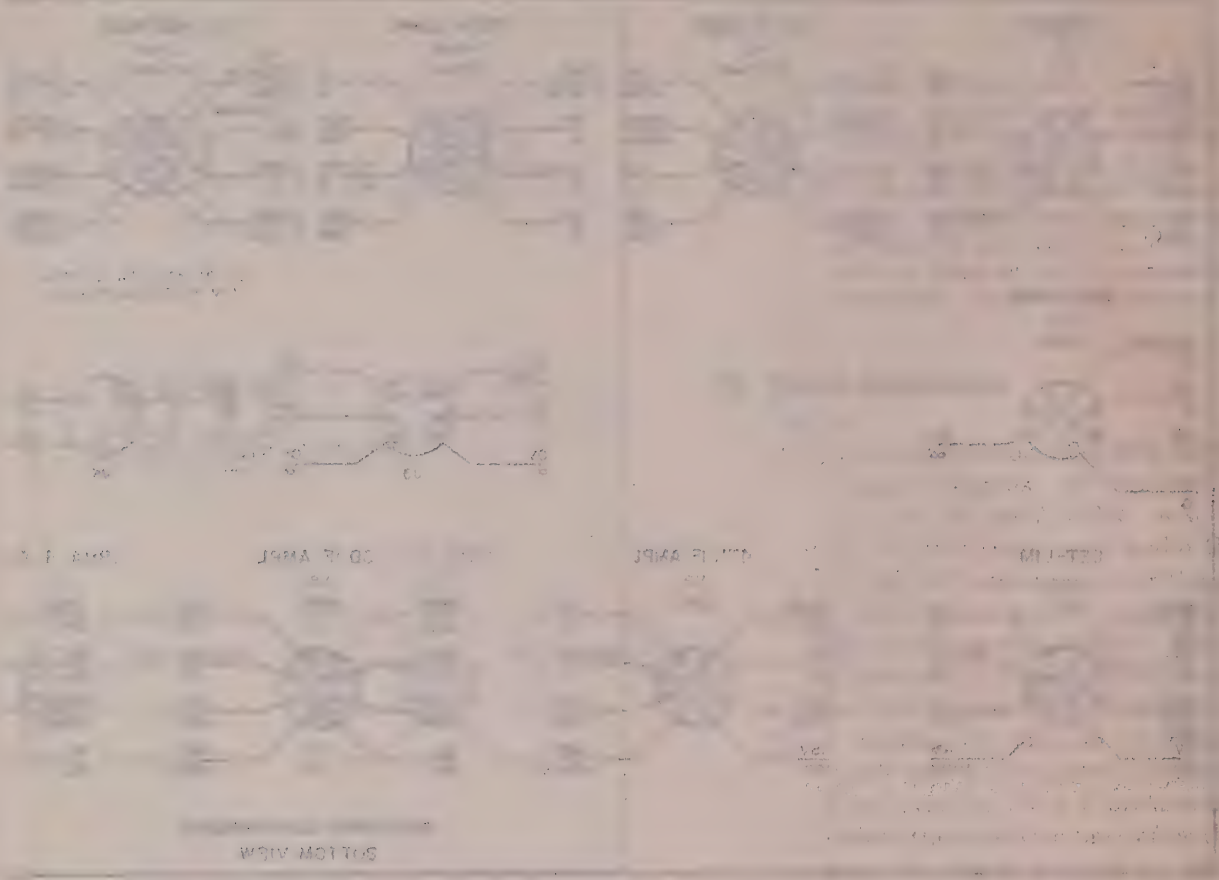
Figure 34. Radio Receiver R-593/GRR, tube-socket voltages and resistance diagram.

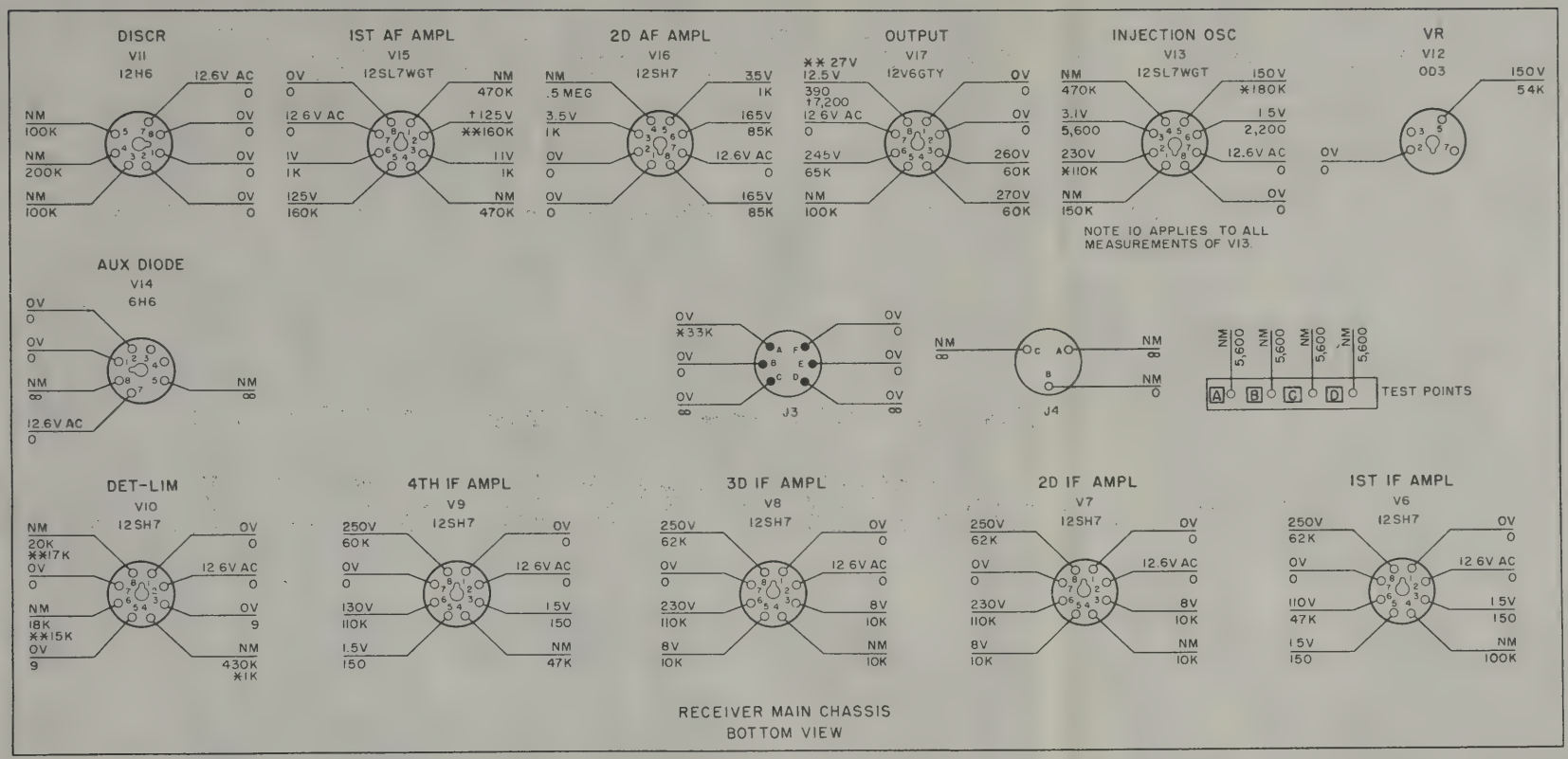


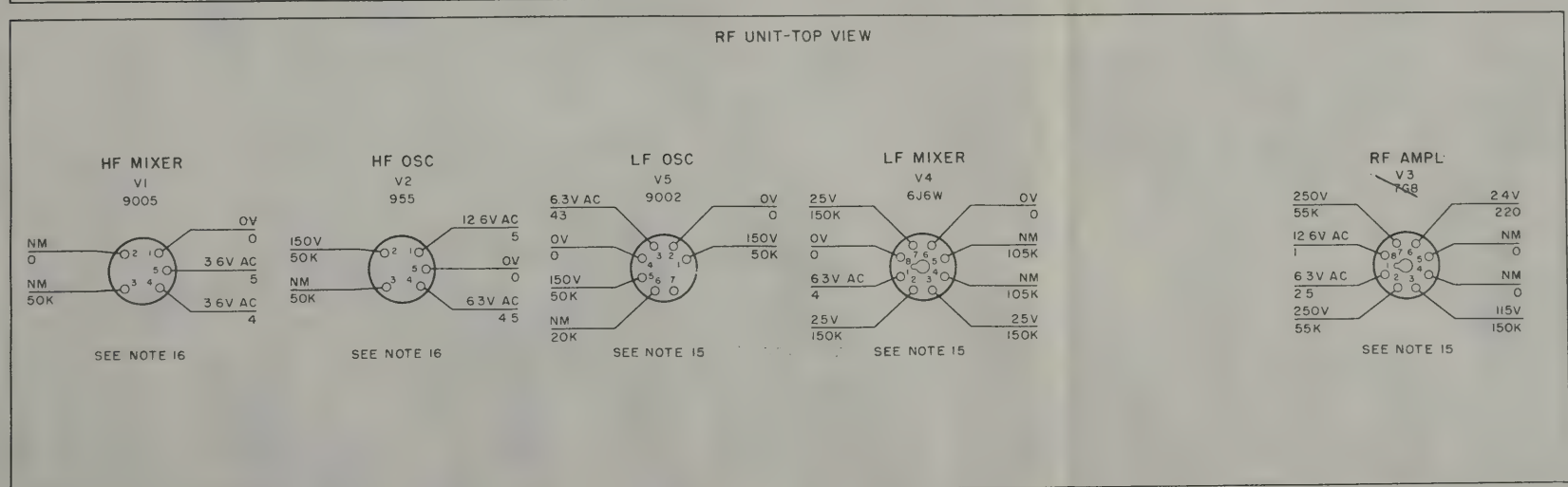


NOTES:

1. LINE VOLTAGE 115V AC.
2. VOLTAGE READINGS ABOVE LINE, RESISTANCE READINGS BELOW LINE.
3. VOLTAGES AND RESISTANCES MEASURED TO GROUND WITH 20,000 OHMS-PER-VOLT METER
4. VOLTAGES ARE DC POSITIVE WITH RESPECT TO GROUND UNLESS OTHERWISE INDICATED







NOTES:

1. LINE VOLTAGE 115V AC.
2. VOLTAGE READINGS ABOVE LINE, RESISTANCE READINGS BELOW LINE
3. VOLTAGES AND RESISTANCES MEASURED TO GROUND WITH 20,000-OHMS-PER-VOLT METER
4. VOLTAGES ARE DC POSITIVE WITH RESPECT TO GROUND UNLESS OTHERWISE INDICATED
5. MVC AVC FM SWITCH AT MVC.
6. * INDICATES MVC AVC FM SWITCH AT FM.
7. SENSITIVITY CONTROL MINIMUM.
8. VOLUME CONTROL MAXIMUM.
9. BEAT-NOTE BALANCE CONTROL AT OFF.
10. † INDICATES BEAT-NOTE BALANCE CONTROL NOT AT OFF.
11. AUDIO SWITCH AT HIGH
12. ** INDICATES AUDIO SWITCH AT LOW
13. NM INDICATES NOT MEASURED
14. ∞ INDICATES INFINITY (OPEN CIRCUIT)
15. SWITCH S1 IN 145-300 MC POSITION FOR THESE READINGS.
16. SWITCH S1 IN 300-600 MC POSITION FOR THESE READINGS.

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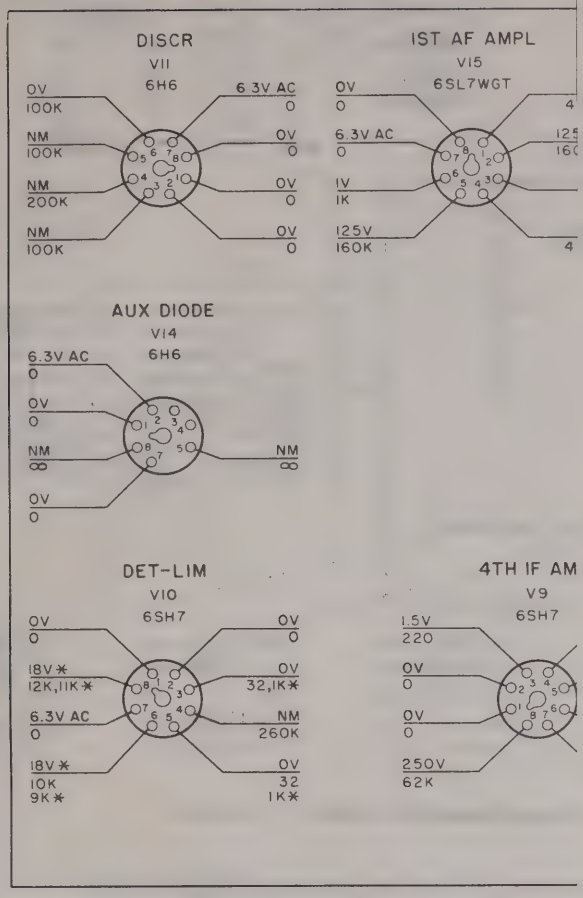
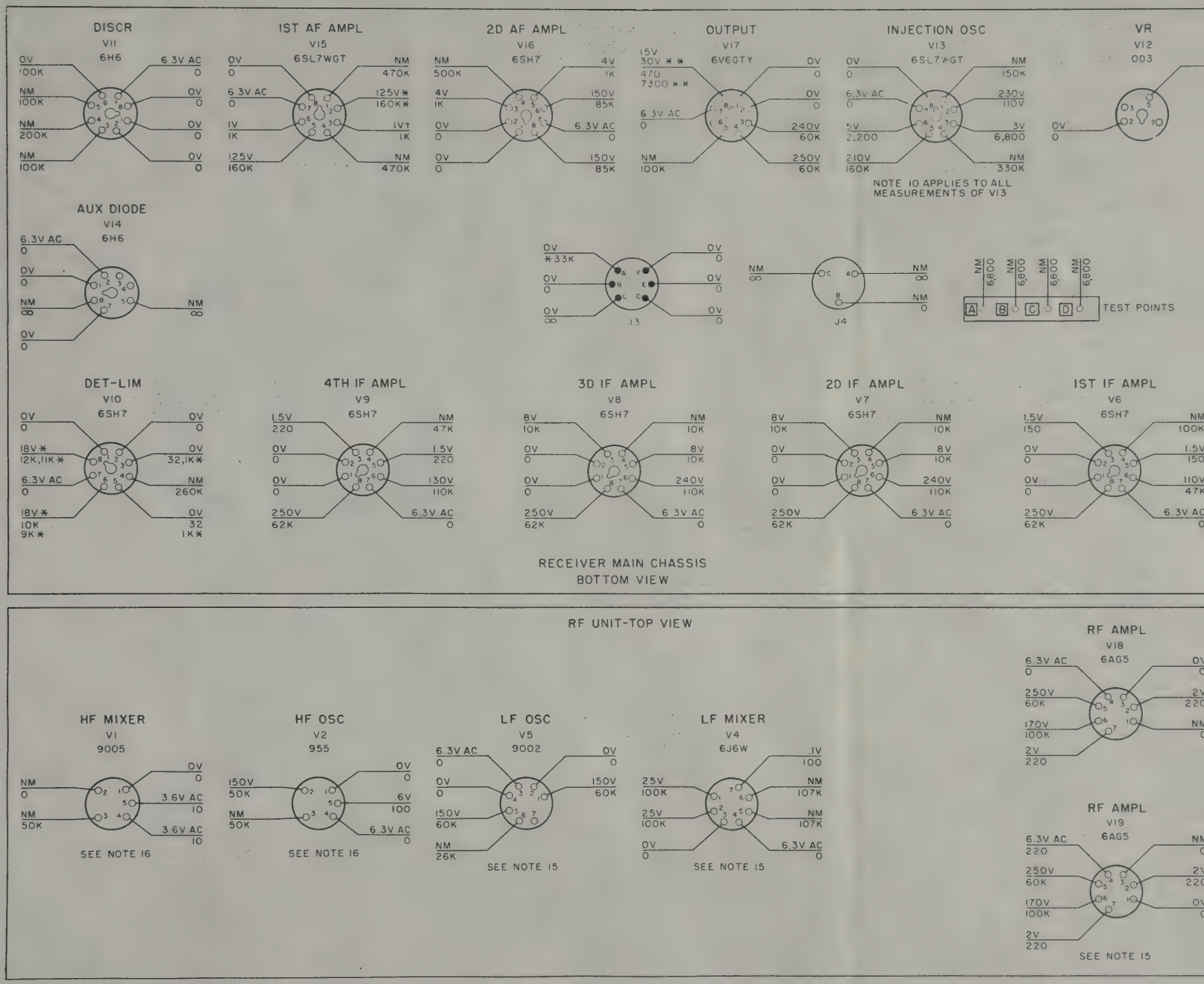
Figure 35. Radio Receiver BC–1269, tube-socket voltage and resistance diagram.



NOTES:

1. LINE VOLTAGE 115V AC.
2. VOLTAGE READINGS ABOVE LINE, RESISTANCE READINGS BELOW LINE.
3. VOLTAGES AND RESISTANCES MEASURED TO GROUND WITH 20,000-OHMS-PER-VOLT METER.
4. VOLTAGES ARE DC POSITIVE WITH RESPECT TO GROUND UNLESS OTHERWISE INDICATED

Figu



NOTES:

1. LINE VOLTAGE 115V AC
2. VOLTAGE READINGS ABOVE LINE, RESISTANCE READINGS BELOW LINE.
3. VOLTAGES AND RESISTANCES MEASURED TO GROUND WITH 20,000-OHMS-PER-VOLT METER
4. VOLTAGES ARE DC POSITIVE WITH RESPECT TO GROUND UNLESS OTHERWISE INDICATED
5. MVC AVC FM SWITCH AT MVC.
6. * INDICATES MVC AVC FM SWITCH AT FM
7. SENSITIVITY CONTROL MINIMUM
8. VOLUME CONTROL MAXIMUM.
9. BEAT-NOTE BALANCE CONTROL, AT OFF
10. † INDICATES BEAT-NOTE BALANCE CONTROL NOT AT OFF.
11. AUDIO SWITCH AT HIGH.
12. ** INDICATES AUDIO SWITCH AT LOW
13. NM INDICATES NOT MEASURED.
14. ∞ INDICATES INFINITY (OPEN CIRCUIT)
15. SWITCH S1 IN 145-300 MC POSITION FOR THESE READI
16. SWITCH S1 IN 300-600 MC POSITION FOR THESE READ

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Figure 36. Radio Receiver BC–1269–A, tube-socket voltage and resistance diagram.

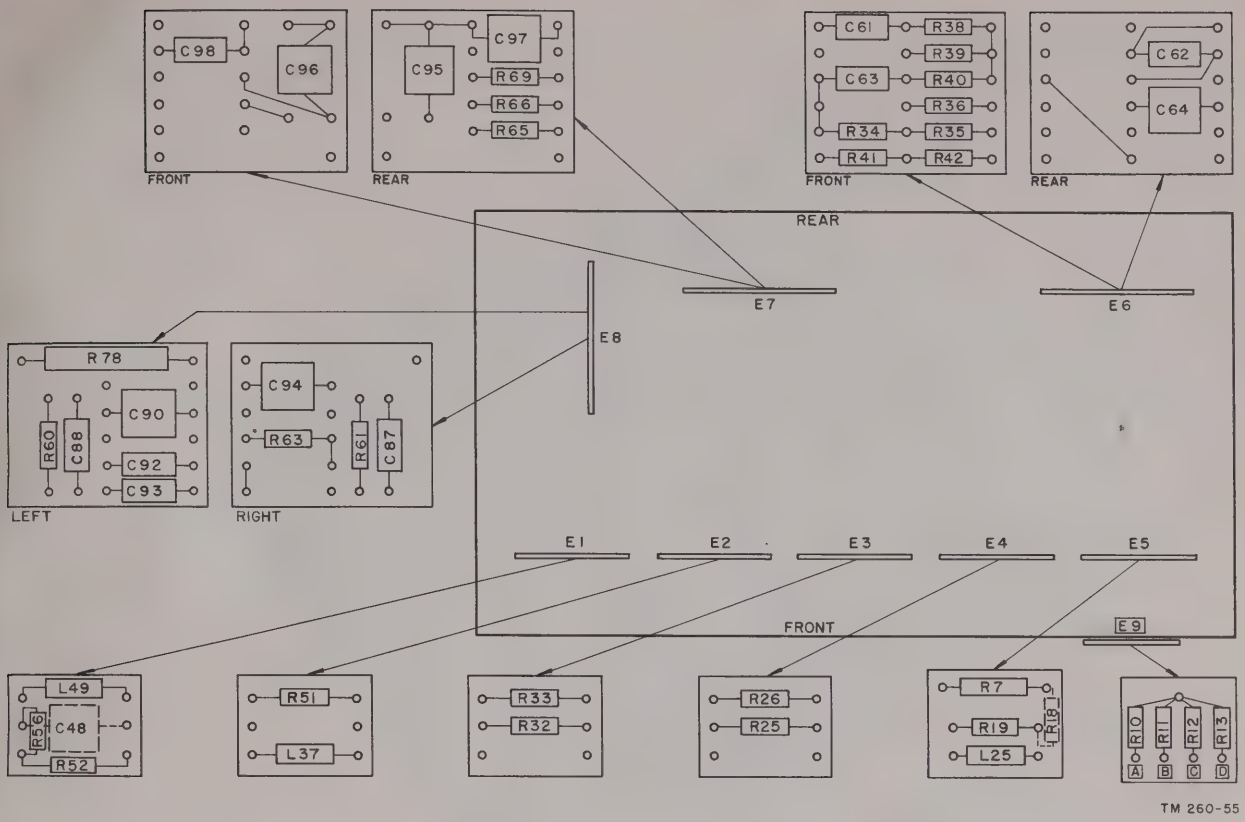


Figure 37. Location of terminal boards in Radio Receiver R–593/GRR.

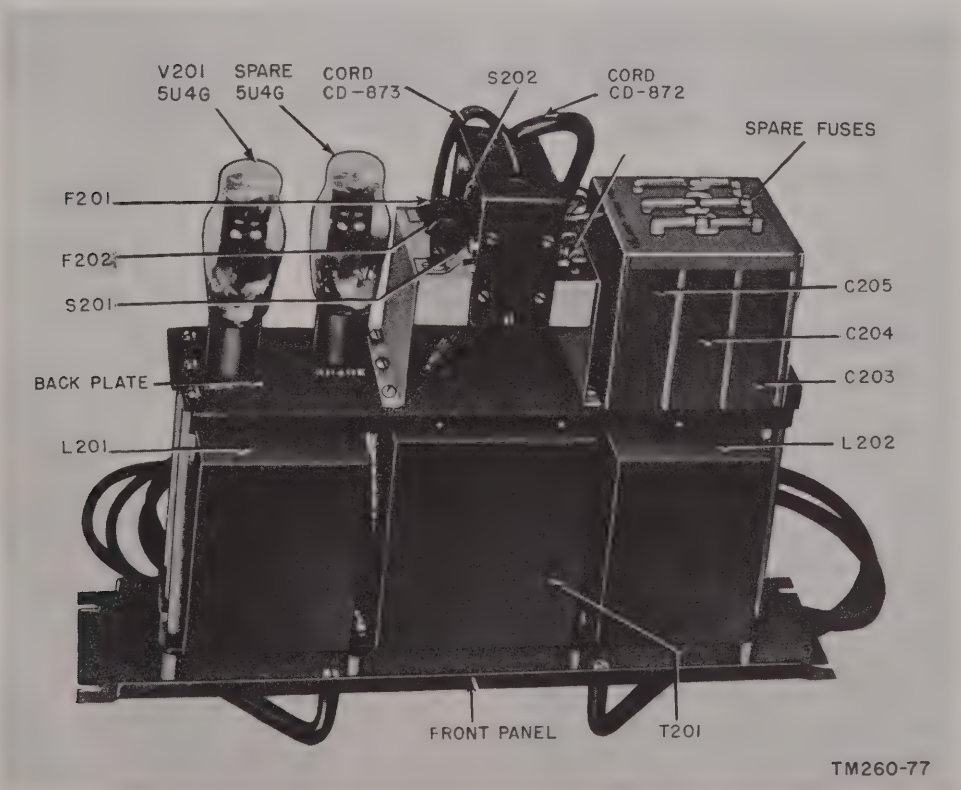


Figure 38. Power Supply Unit RA–61–A, removed from case.

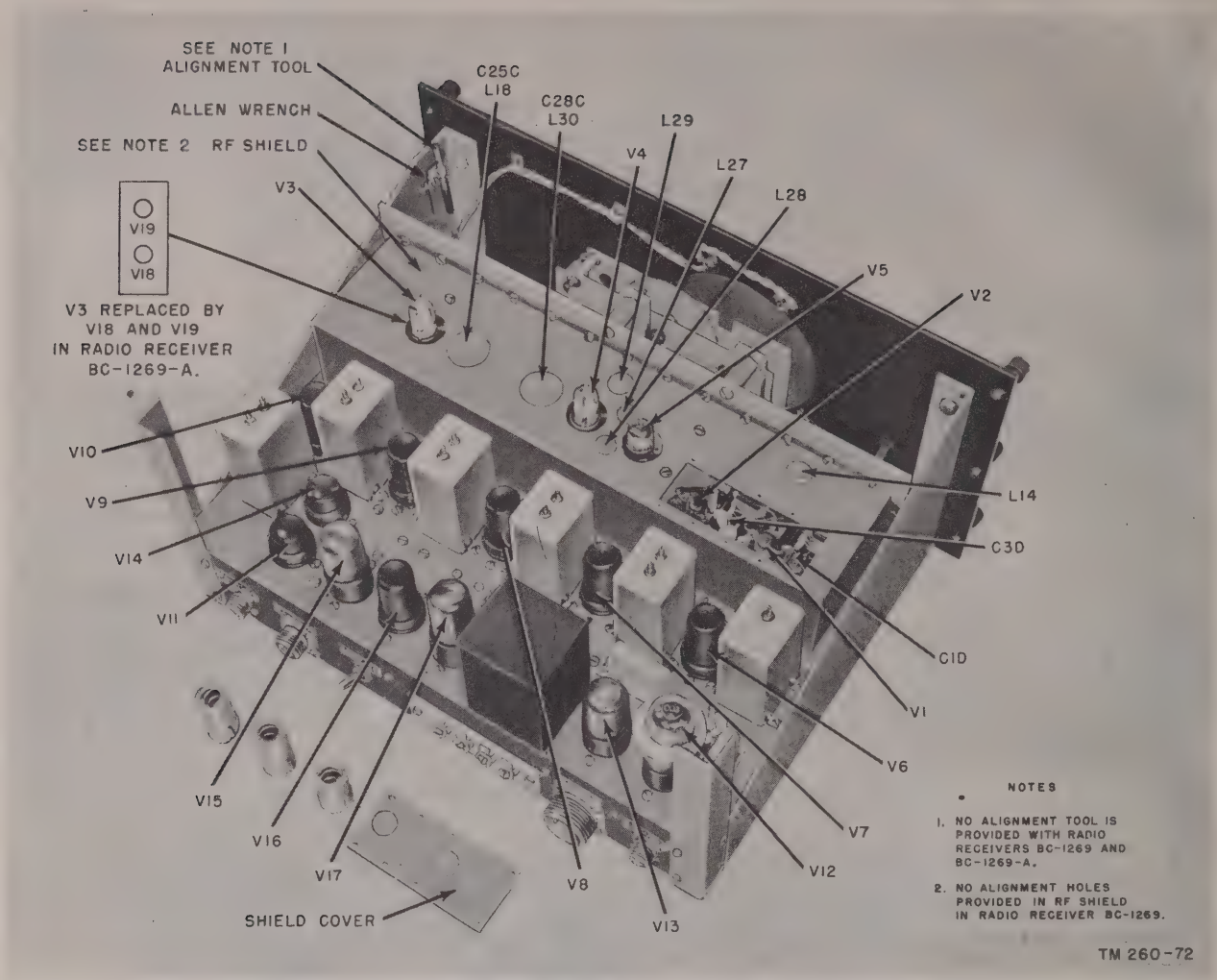


Figure 39. Radio Receivers BC–1269, BC–1269–A and R–593/GRR, tube location.

(6) Check the wiring and soldering in each stage during the procedure.

Caution: Do not remove the shield cover from the rf unit (fig. 39) until the trouble has been traced to that particular unit. Do not damage the wiring by pushing it back and forth during inspection. Be careful not to damage the receiver in any other way.

(7) Misalinement of one or more stages of the receiver will cause reduced output. Misalinement of the hf oscillator may prevent any output.

(8) When trouble is localized in a given stage, first test the tube if such a test is indicated; then measure the socket voltages, and finally measure the resistance at the tube socket of that stage.

(9) Trouble in a circuit may not cause changes in voltage and resistance measurements at the tube socket. The instructions included in this paragraph are merely a guide and should suggest other procedures, such as voltage and resistance measurements on individual parts.

(10) Remove only *one* tube at a time when testing. Check the type number of the tube; test the tube. If it is not defective, return it to its proper socket before another tube is removed.

(11) At each step, it is assumed that all previous steps were completed satisfactorily. Isolate and clear any trouble located before proceeding with any succeeding steps.

b. Audio Amplifiers.

(1) Connect a 400-cycle-per-second (cps) output from Audio Oscillator TS–382A/U through a .01-microfarad (μf) capacitor to pin 5 of output tube V17 (fig. 39); connect the ground lead to the receiver chassis. Adjust the signal generator output to produce an audible tone in the headset or loudspeaker. Momentarily set the AUDIO HIGH-LOW switch to LOW. The amplitude of the output signal should decrease. If the stage does not operate normally, check output transformer T7 for correct winding resistances, shorts to ground, and shorts between windings; test headset jacks J5 and J6 for shorts; test V17; check B+ circuit for shorts; check for correct resistance of resistors R76 and R77, and for shorted capacitor C101.

(2) Connect the output lead of the audio oscillator to the plate (pin 8) of second af amplifier V16. Listen for an output signal of approximately the same intensity as indicated in (1) above. If no signal is heard, check coupling capacitor C100 and bypass capacitor C99.

(3) Introduce the test signal to the grid (pin 4) of V16. The output should be much louder than when it was applied to the plate terminal. If there is no signal or a weak signal, check tube V16, check the overall resistance of VOLUME CONTROL R72; check resistance from the arm of the control to ground. Measure the value of cathode resistor R74. Check capacitor C98 for a short circuit.

(4) With the MVC–AVC–FM switch set to FM, apply the audio signal to the plate (pin 2) of first af amplifier tube V15B. The output level should remain approximately the same as indicated in (3) above. If the signal is weak or there is no output, check coupling capacitor C95.

(5) Introduce the signal at the grid (pin 1) of V15B. The output level should increase considerably. If there is little change in amplitude or no signal, check the tube (V15) and check cathode resistor R67. Check the voltage at the plate (pin 2) of the tube.

(6) Switch the MVC–AVC–FM switch to MVC. Apply the audio signal to the grid (pin 4) of V15A. The output amplitude should be nearly the same as that indicated in (5) above. If the output is considerably decreased, or if there is no output, check the tube (V15); check the voltage at the plate (pin 5); check cathode resistor R68 and coupling capacitor C96.

(7) Without disturbing the signal generator attenuator setting, apply the audio test signal across detector load resistor R56. The amplitude of the output signal should be approximately the same as that given in (6) above. If the output is weak, or if there is no output, check coupling capacitor C94. Test the shielding lead between resistor R52 and capacitor C94 for a short circuit and continuity.

c. If. Amplifiers.

(1) Set the receiver controls (fig. 13) as follows:

Control	Setting
SENSITIVITY	Maximum.
VOLUME	Maximum.
TONE	Maximun clockwise.
BEAT-NOTE BALANCE	OFF.
MVC–AVC–FM	MVC.
FREQUENCY BAND	145–300 MC.

(2) The same general procedure of signal substitution as in *b* above should be followed for the if. amplifiers. Apply a 30 percent modulated, 15-mc signal from Signal Generator TS–497A/URR to the grid (pin 4) of the detector-limiter stage (V10). Proceed from plate to grid for each if. amplifier stage until the grid of the first if. stage (V6) is reached. It should be necessary to reduce the output of the signal generator as the test progresses if the gain of each stage is normal. In the event of a weak response or no signal output, check the tube in the defective stage. Also check the socket voltages and resistances (figs. 34–36). Do not attempt to realine the stage until other causes for trouble have been checked.

Note. All if decoupling resistors and capacitors are inside the shield cam for the associated if. transformer.

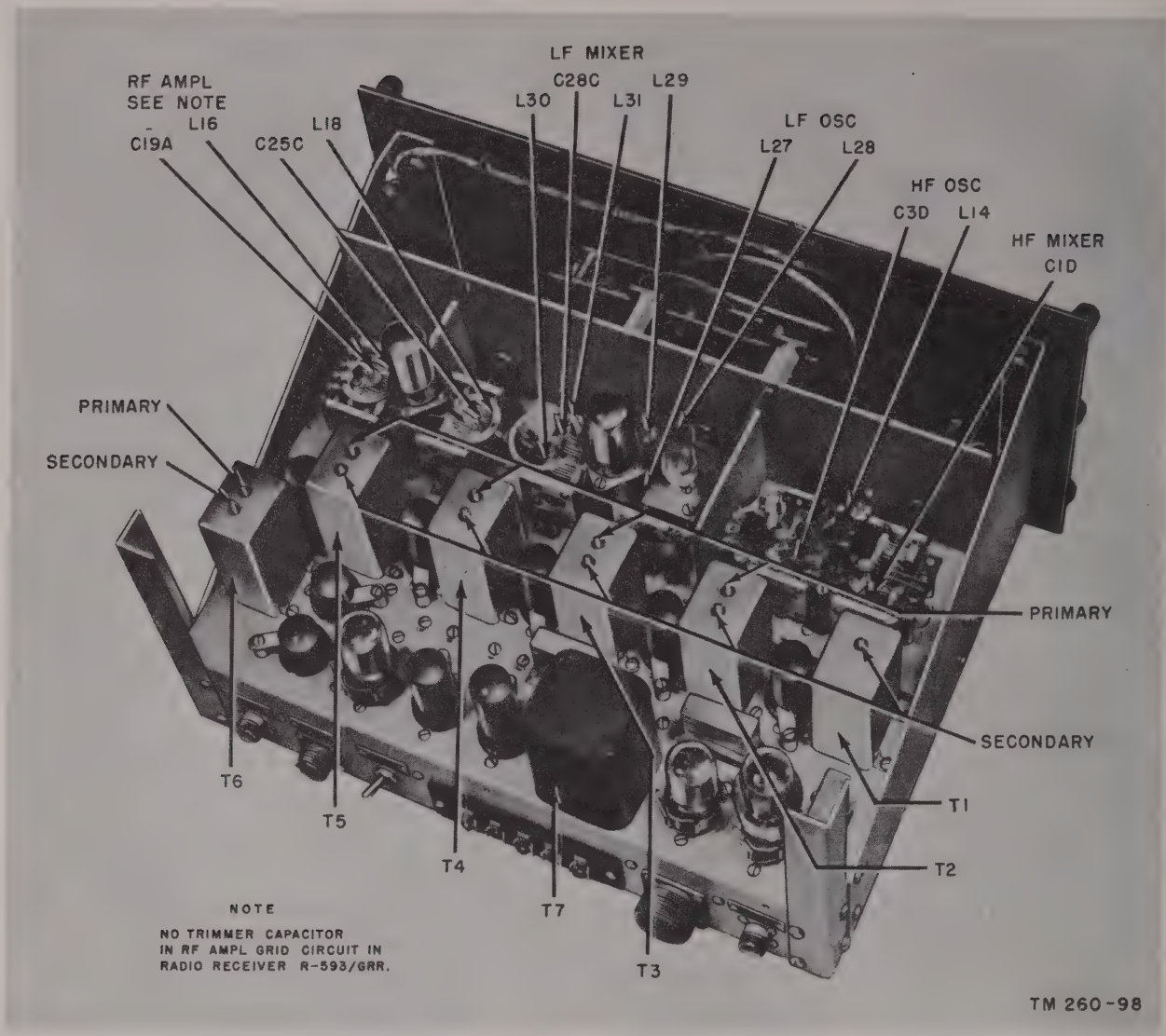


Figure 40. Radio Receivers BC–1269 and R–593/GRR, alinement points.

d. Rf Section, Lf Band.

(1) Preliminary measurements in Radio Receiver R–593/GRR can be taken at test points A, B, C, and D on terminal board E9 to indicate operation of certain stages (fig. 37). This is terminal board E24 in Radio Receiver BC–1269–A, and E10 in the BC–1269.

(2) When oscillator stage V5 is oscillating, a voltage of −1.5 to −3.5 volts will be measured at test point C on the terminal board; use Electronic Multimeter TS–505/U. The absence of any readable voltage at this terminal indicates that the stage is not oscillating. Check tube V5 and the plate voltage (pins 1 and 5). Test coupling capacitor C29. Check for short circuits in associated wiring.

Note. It is possible for the oscillator to be tuned to an improper frequency. This condition can be corrected by following the alinement procedure in paragraph 88.

(3) The rectified grid voltage of mixer stage V4 measured at test point D on the terminal board should be −.2 volts; use the vacuum-tube voltmeter (vtvm). The absence of a measurable voltage at this point may be traced to a defective mixed tube V4. Check the tube; in Radio Receivers R–593/GRR and BC–1269–A, check cathode resistor R85. The lack of voltage at test point D may

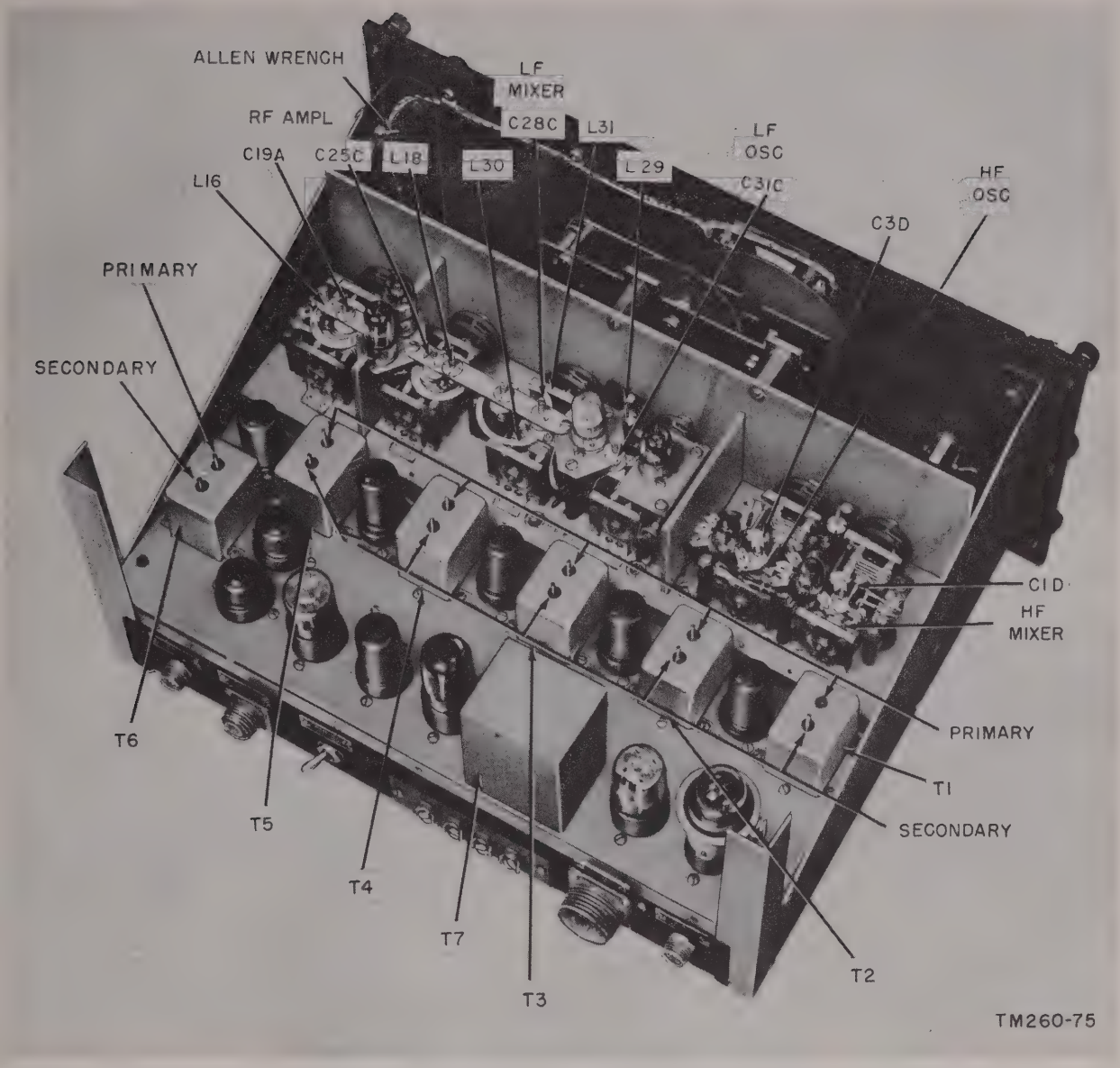


Figure 41. Radio Receiver BC–1269–A, alinement points.

also indicate that the oscillator stage is not functioning properly.

(4) Set Signal Generator TS–497A/URR for 150 mc, modulated 30 percent at 400 cps. Apply this signal to the antenna terminals, marked ANT 145–300, on the back of the receiver. Vary the receiver tuning about the 150-mc calibration mark and adjust the output level of the signal generator to obtain an audible output. If no output is indicated or an excessive input signal is required (par. 79), check rf amplifier tube V3 or V18 and V19 in the BC–1269–A; check the plate voltage; and check the cathode bias resistor. Check all bypass capacitors for short circuits. Examine the coils and wiring for broken or shorted wiring.

e. Rf Section, Hf Band.

(1) Rotate the FREQUENCY BAND switch to the 300–600 MC position.

(2) Using the vtvm, measure the voltage at test point B on the terminal board. When the oscillator stage V2 is oscillating, a voltage of −.25 to −.50 volts will be measured at this point. The

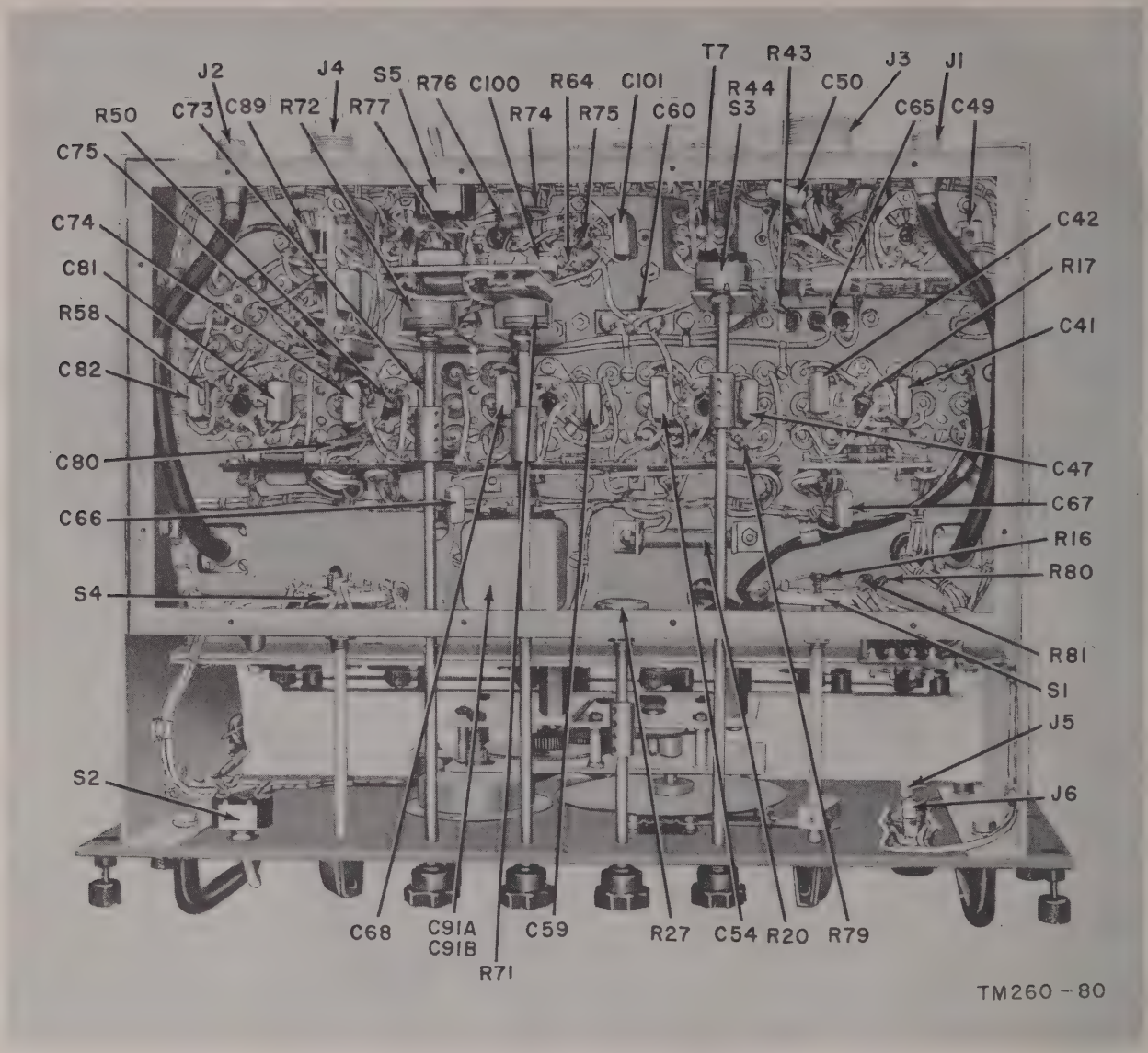


Figure 42. Radio Receiver R–593/GR, bottom view.

absence of a measurable voltage indicates that the oscillator stage is not functioning. Check tube V2 and the voltage at the plate (pin 2). Check rf chokes L11 and L12 for continuity.

(3) Measure the rectified voltage of diode mixer stage V1 at test point A of the terminal board. The normal voltage at this point is —.25 volts. If an abnormal reading is obtained, check tube V1; check coils L4, L9, and L14 for continuity. Check the capacitors in the circuit for shorts. Check for open or shorted wiring.

(4) Connect the output of the signal generator to the terminals marked ANT 300–600 at the rear of the receiver. Set the generator for 350 mc, modulated 30 percent at 400 cps. Vary the receiver tuning until an audible output is noted. If an excessively strong input signal is required (par. 79) or there is no receiver output, test tube V1; check inductance L1 for a short; check the shielded twinlead cable from the input receptacle to J1 for continuity and shorts.

79. Stage Gain Charts

a. The stage gain chart given in *c* below lists the maximum input voltages in microvolts (μv)

required at each of the if. stages of the receiver to produce a signal output of 2.45 volts across an output load of 600 ohms for Radio Receiver BC–1269–A or R–593/GRR or 1.58 volts across an output load of 250 ohms for Radio Receiver BC–1269. Use this chart as a standard when troubleshooting to check the gain of each if. stage, or group of stages. Sensitivity information for the receiver is given in paragraph 92.

b. When performing if. stage gain tests, set the receiver controls as follows:

(1) MVC–AVC–FM switch to MVC.
(2) VOLUME control to maximum.
(3) SENSITIVITY control to maximum.
(4) BEAT-NOTE BALANCE control to OFF.
(5) AUDIO HIGH-LOW switch to HIGH.

c. Connect the required load resistor, either the 600-ohm or the 250-ohm resistor, across the output terminals of transformer T7. Measure the output voltage with the vtvm. Make connection to the control grid of each if. stage through a 100-micromicrofarad ($\mu\mu$f) capacitor in series with the output of the signal generator. Connect the signal generator ground lead to the receiver chassis.

Signal generator frequency (mc)	Signal generator output connection	Signal generator output (μv)
15	First if. (V6) control grid	15
15	Second if. (V7) control grid	150
15	Third if. (V8) control grid	1, 500
15	Fourth if. (V9) control grid	15, 000
15	Fifth if. (V10) control grid	150, 000

Section II. REPAIRS

80. Replacement of Parts

Careless replacement of parts often makes new faults inevitable. Note the following points:

a. Before a part is unsoldered, note the position of the leads. If the parts, such as a transformer, has a number of connections, tag each of the leads to it.

b. Be careful not to damage other leads by pulling or pushing them out of the way.

c. Do not allow drops of solder to fall into the set, since they may cause short circuits.

d. A carelessly soldered connection may create a new fault. It is very important to make well-soldered joints, since a poorly soldered joint is one of the most difficult faults to find.

e. The miniature tubes are surrounded and secured by metal shields. Remove the shields by pushing them toward the socket and twisting them slightly counterclockwise until the lock releases. Then pull them away from the tube. Voltage regulator tube V12 is held in its socket by a hat clamp. To remove the clamp, lift up on the clamp handle. Replace the clamp by setting it on the top of the tube and pushing the handle down so that the clamp rod passes through the hole. Use enough downward pressure to hold the tube firmly in place; at the same time, make sure that the clamp will not spring upward.

f. To gain access to the tubes in the hf band, rf section of the receiver, remove the small shield cover located on the top of the rf shield (fig. 39).

81. Disassembly

Disassembly of the dial drive assembly and mechanical linkage in the tuning capacitor ganging system should be performed only by qualified field and depot maintenance personnel. No attempt should be made to remove the gears in the gear train. If defective, the gear train must be replaced as an assembly (fig. 16).

82. Refinishing

Instructions for refinishing badly marred panels and external surfaces are given in TM 9–2851, Painting Instructions for Field Use.

83. Adjustments

A heavy shock may cause the retaining spring of a flexible coupling in the dial drive assembly to disengage (fig. 16). When the coupling is reassembled, the spacing between disks must be adjusted so that the drive studs clear the opposite disk face. This clearance prevents excessive drive friction and relieves stresses on the variable capacitors due to any slight misalinement of the drive shaft.

84. Tuning Dial Mask

The exact positioning of the dial mask is accomplished by a ball detent located at the lower end of the dial mask. A severe jar may cause the ball to become dislodged. Use the following procedure when replacing the ball: Remove the re-

ceiver from the case or rack and turn it upside down. Loosen the nuts holding the ball retaining spring; back these nuts out just far enough to allow the ball to be pressed in position under the spring. Retighten the nuts. Return the receiver to its case or rack.

Section III. ALINEMENT PROCEDURES

85. Test Equipment and Tools Used for Alinement

Because of the extreme span of frequencies needed to aline the receiver, it is necessary to use two rf signal generators to cover the range. The if. frequency is 15 mc, and the rf frequency range extends from 145 mc to 600 mc in two bands. The following test equipment and tools are required for alinement of the receiver:

Nomenclature	Common name	Technical manual
Signal Generator TS–497A/URR	Signal generator	TM 11–5030
Signal Generator AN/URM–49	Signal generator	
Elctronic Multimeter TS–505/U	Vtvm	TM 11–5511
Multimeter TS–352/U	Multimeter	TM 11–5527
Frequency Meter AN/URM–80	Frequency meter	
Frequency Meter TS–186A/UP	Frequency meter	
600-ohm, 2-watt resistor		
250-ohm, 2-watt resistor		
Headset HS–30–(*)		
or		
Electrical Headset H–113/U		
or		
Loudspeaker LS–3		
Alinement tool		

86. Alinement and Adjustment Procedures

a. Necessity for Alinement.

(1) Be careful to avoid unnecessary adjustment. The components of the *receiver* have been designed to reduce to a minimum the necessity for alining the stages. When vacuum tubes are replaced, it should not be necessary to realine the receiver; the small variation introduced is usually negligible.

(2) When an if. transformer has been replaced, it is considered expedient to aline only the stage affected. Satisfactory adjustment may be made by peaking the noise level. If the sensitivity of the receiver is not as specified (par. 92), realinement of the if. amplifiers is necessary.

(3) When a variable capacitor must be replaced or readjusted, the correct position for mechanical alinement is at maximum capacity (plates fully meshed). All variable capacitors should be at maximum capacity when the index dial calibration is under the hairline. The dial index mark is the unnumbered calibration line at the extreme low-frequency end of each band.

b. Preliminary Operations.

(1) Remove the *receiver* from the rack, or from Case CS–138. Reconnect Cord CS–872 from Power Supply Unit RA–61–A. Do not reconnect the antenna transmission lines.

(2) Allow the receiver to warm up for at least ½ hour before any adjustments are made. Allow a suitable warmup period for the test equipment.

(3) Make preliminary settings of the controls according to the chart below. Instructions for changing settings is given in the procedure for each adjustment.

Control	Setting
POWER	ON.
FREQUENCY BAND	300–600 MC.
BEAT-NOTE BALANCE	OFF.
SENSITIVITY	Maximum clockwise.
TONE	Minimum(counterclockwise).
VOLUME	Approximately midposition.
MVC–AVC–FM	MVC.
AUDIO HIGH-LOW	HIGH.
TUNING	Any convenient setting. (No external signals should be received).

87. If. and Discriminator Alinement
(figs. 40 and 41)

a. General. The if. amplifier stages are alined with an am signal. The discriminator circuit is alined with an unmodulated signal. The calibration of the signal generators should be checked against frequency standards, such as Frequency Meters TS–186A/UP and AN/URM–80 with each change of frequency in the alinement.

b. Preliminary Test Setup. Set the receiver controls in the manner described in paragraph 86*b*. For Radio Receiver BC–1269–A or R–593/GRR, connect a 600-ohm, 2-watt resistor across terminals 6 and 9 on the OUTPUT terminal board at the rear of the receiver; terminals 7 and 8 should be connected directly together. For Radio Receiver BC–1269, connect a 250-ohm, 2-watt resistor across terminals 4 and 6 on the OUTPUT terminal board. Set the vtvm to read ac volts and connect it across the output load resistor. Use a high-voltage scale initially. Adjust Signal Generator TS–497A/URR for 15-mc output, modulated approximately 30 percent at 400 cycles. Plug in a headset or loudspeaker.

c. If. Alinement.

(1) Connect the output of the signal generator to the socket labeled ANT 300–600 at the rear of the receiver. Adjust the attenuator until a signal is heard in the headset or loudspeaker. Readjust the signal generator output and the scale setting of the vtvm for approximately a half-scale reading on the 2-volt scale.

(2) Adjust the secondary of T5 in the detector-limiter circuit for maximum output; adjust the primary of T5 for maximum output. When it becomes necessary to reduce the output of the receiver, use the attenuator of the signal generator.

(3) In a similar manner, adjust the secondary and primary windings of transformers T4, T3, and T2.

(4) Adjust input transformer T1, which has only one adjustment (secondary). No further adjustment of this transformer can be made, or is required.

(5) Peak adjustment of L14 in the hf mixer circuit.

(6) Set FREQUENCY BAND switch to 150–300 MC. Connect the 15-mc output of the signal generator to the socket marked ANT 145–300 MC. Peak adjustment of coil L29 in the if. mixer circuit.

d. Discriminator Alinement.

(1) Adjust the signal generator to supply an unmodulated 15-mc signal.

(2) Set the MVC–AVC–FM switch to FM.

(3) Connect the output of the signal generator to the socket marked ANT 300–600. Set the FREQUENCY BAND switch to 300–600 MC.

(4) Set the vtvm on the 4-volt dc scale and connect it between the junction of resistors R60 and R61 and ground. Adjust the primary winding, L46 of T6, for maximum output.

(5) Set the vtvm to the 5-volt zero center dc scale and connect it across resistors R60 and R61 (pin 4 of V11 to ground). Adjust the secondary winding, L47 of T6, for zero output.

(6) Detune the signal generator to either side of the center frequency. When the signal frequency is increased, an output of one polarity should be observed on the vtvm. When the signal frequency is decreased from the center frequency, an output of the opposite polarity should be observed. A deviation of plus or minus 100 kc should result in an approximate reading of plus or minus 1 volt. If these readings are not obtained, readjust L47.

88. Rf Adjustment of Lf Band
(figs. 39–41)

Note. The calibration of the signal generator should be checked against a frequency standard such as Frequency Meter TS–186A/UP before proceeding with the lf band alinement procedure and each time the frequency is changed.

a. Radio Receiver R–593/GRR. It is not necessary to remove the shield from the rf section when alining Radio Receiver R–593/GRR. The tuning adjustments may be reached by removing the snap covers over the holes provided on top of the rf shield (fig. 39).

(1) Set vtvm on the 2-volt ac scale and connect it across the 600-ohm load resistor (par. 79) on the output terminal strip.

(2) Connect the output of the signal generator to the socket marked ANT 145–300 MC at the rear of the receiver. Set the FREQUENCY BAND switch to 145–300

MC. Adjust Signal Generator TS-497A/URR to supply an unmodulated 275-mc signal.

(3) Set the MVC–AVC–FM switch to MVC. Turn the BEAT–NOTE BALANCE control on.

(4) Set the receiver tuning dial to 275 mc.

(5) Remove the circular access cover for capacitor C25C in the low-frequency rf amplifier circuit (fig. 39). Reach through the hole in the top of the rf shield and loosen the mounting nuts of paddle-shaped capacitor C25C (fig. 39) with a socket wrench. Adjust the capacitor by moving the tuning paddles together or apart as required to produce a maximum output indication on the vtvm.

Note. The adjustment of the lf band mixer and oscillator stages as instructed in (6) and (7) below is critical and requires successive and repeated slight changes in the settings of the tuning paddles of capacitor C28C and the length of combined inductors L27 and L28.

(6) Following a procedure similar to that in (5) above, adjust capacitor C28C in the mixer circuit for maximum output (fig. 39). Reduce the output of the signal generator as required to prevent overloading the receiver.

(7) Remove the access cover for inductors L27 and L28 (fig. 39) in the lf oscillator circuit. Loosen the mounting nuts for the inductors. Enough friction should remain to permit good electrical contact. Lengthen or shorten L27 and L28 in their slotted mountings, until maximum output is obtained as indicated on the output meter.

Caution: Be careful to insure that the oscillator is tuned to a frequency 15 mc *higher* than the rf signal. To determine whether this is so, rotate the TUNING control to a frequency 30 mc lower than the rf test signal. The image frequency should be heard. If it is not heard, repeat the adjustment of oscillator inductors L27 and L28, starting in the position of their shortest length.

(8) Repeat the procedures in (6) and (7) above until maximum output is obtained.

(9) Rock the frequency control of the signal generator to both sides of the 275-mc calibration mark. Note the dial reading at which maximum output is obtained. It should be within 8 mc of 275 mc.

(10) Change the frequency setting of the receiver to 150 mc. Accurately tune in the signal by rotating the frequency control on the signal generator. Maximum output should occur within 5 mc of the 150-mc calibration mark. Low frequency rf amplifier coil L18 and mixer coil L30 (fig. 40) may be depressed or raised slightly to obtain maximum output.

(11) When both the 275-mc and 150-mc calibrations are off in the same direction, set the receiver and signal generator to 275-mc and readjust the length of oscillator inductors L27 and L28 (fig. 40). Distribute any calibration errors evenly over the entire dial. Recheck the oscillator frequency using the method in the *caution* in (7) above.

(12) If a change in the oscillator tuning (adjustment of inductors L27 and L28) is made, repeat the procedures in (6) through (11) above.

b. Radio Receiver BC–1269–A. The lf band rf alinement procedure for Radio Receiver BC–1269–A is similar to the procedure in *a* above, except for *a* (7). Oscillator tuning is accomplished in Radio Receiver BC–1269–A by adjusting trimmer capacitor C31C (fig. 41).

c. Radio Receiver BC–1269.

(1) Rf alinement of the low-frequency band is similar to the procedure outlined in *a* above, except for *a* (7). As with Radio Receiver BC–1260–A, oscillator tuning is accomplished by adjustment of capacitor C31C.

(2) The rf shield must be removed from the rf sections before adjustments can be made, since there are no access covers. After making an adjustment for maximum output, note the reading on the output indicator. Replace the shield in position and rock the receiver TUNING control for maximum output. If the output indication decreases, remove the shield and shift the position of the adjustment. Replace the shield, rock the receiver TUNING control, and observe the meter reading. Repeat these operations until the output indication is maximum with the rf shield in place.

89. RF Adjustment of Hf Band

(figs. 39–41)

Note. The calibration of the signal generators should be checked against frequency standards such as Frequency Meters TS–186A/UP and AN/URM–80 before proceeding with the hf band alinement procedure.

a. Retain the output load resistor connections as in paragraph 87*b*.

b. Connect the vtvm across the appropriate output terminals at the rear of the receiver.

c. Set Signal Generator TS–497A/URR to provide an unmodulated 350-mc signal.

d. Connect the output of the signal generator to the socket marked ANT 300–600 at the rear of the set. Set the FREQUENCY BAND switch of the receiver to 300–600 MC.

e. Set the MVC–AVC–FM switch in the MVC position and set the BEAT-NOTE BALANCE control to ON.

f. Set the receiver dial to 350 mc.

Note. Figure 40 shows the hf alinement points for Radio Receivers R–593/GRR and BC–1269. Figure 41 shows the hf alinement adjustments for Radio Receiver BC–1269–A.

g. To reach capacitors CID and C3D in Radio Receiver R–593/GRR, remove the two circular access covers from the shield cover (fig. 39). No access covers are provided in Radio Receivers BC–1269 and BC–1269–A; to reach capacitors CID and C3D in these receivers, remove the six screws which hold the shield cover for the hf section and remove the cover.

Note. The adjustment of the hf band mixer and oscillator stages described in *h* and *i* below is critical and requires successive and repeated slight changes in the settings of the respective capacitors.

h. Adjust capacitor CID in the hf band mixer circuit for maximum output.

i. Adjust capacitor C3D in the hf band oscillator circuit for maximum output.

Caution. For proper tracking, the oscillator in the hf band rf section is normally tuned 15 mc *below* the rf signal. To determine whether this is so, rotate the TUNING control to a frequency 30 mc *higher* than the rf test signal. The image frequency should be heard; if not, readjust the oscillator, starting with the maximum capacity of capacitor C3D.

j. Repeat the procedure in *h* and *i* above until maximum output is obtained.

k. Rock the tuning dial of the signal generator and note the dial reading at which maximum output occurs. It should be within 10.5 mc of the 350-mc calibration mark.

l. Change the frequency setting of the receiver to 550 mc. Check for calibration error by rocking the tuning control of the signal generator about the 550-mc calibration mark. Maximum output should occur within 16.5 mc of the normal setting.

m. If both points are off calibration in the same direction, readjust oscillator trimmer C3D (fig. 40). Distribute any calibration errors evenly over the entire dial. If the calibration errors are in different directions, do not attempt to correct the condition unless the deviation errors are greater than 10 mc. Recheck the oscillator frequency using the method given in *i* above.

n. If a change in the oscillator tuning has been made, it will be necessary to repeat the procedures given in *h* through *l* above.

o. Replace the shield cover and reassemble the receiver.

Section IV. FINAL TESTING

90. General

This section is intended as a guide to be used in determining the quality of a repaired receiver and power supply. The minimum test requirements outlined in paragraphs 92 and 93 may be performed by maintenance personnel with adequate test equipment and the necessary skills. Repaired equipment meeting these requirements will furnish uniformly satisfactory operation.

91. Test Equipment Required for Final Testing

The test equipment required for testing the repaired equipment and the appropriate manuals are listed below:

Nomenclature	Common name	Technical manual
Signal Generator TS–497A/URR	Signal generator	TM 11–5030
Signal Generator AN/URM–49	Signal generator	
Signal Generator AN/URM–70	Signal generator	
Audio Oscillator TS–382A/U	Signal generator	TM 11–2684A
Spectrum Analyzer TS–723/U	Spectrum analyzer	
Frequency Meter TS–186A/UP	Frequency meter	
Frequency Meter AN/URM–80	Frequency meter	
Multimeter TS–352/U	Multimeter	TM 11–5527
Electronic Multimeter TS–505/U	Vtvm	TM 5511
Electronic Multimeter ME–6A/U	Vtvm	TM 11–5549
Wattmeter TS–340/U	Wattmeter	
Variac CN–164A/U	Variac	
Resistor, nonreactive, 49 ohms		
Resistor, 600 ohms, 2 watts		
Resistor, 250 ohms, 2 watts		
Resistor, 1.1 ohms, 60 watts		
Resistor, 4.5 ohms, 60 watts		
Resistor, 2200 ohms, 60 watts		
Capacitor, 1 μf, 600 volts		

92. Receiver Tests

a. General.

(1) Before proceeding with final testing, all test equipment should be warmed up for at least ½ hour to stabilize the instruments.

(2) The line voltage required for Power Supply Unit RA–61–A must be either 115 or 320 volts at a frequency of 60 cycles (par. 10).

(3) No adjustments will be made unless the circuit under test fails to meet the minimum test requirements. If necessary, adjustments will be made in accordance with alinement procedures given in paragraphs 85 through 89.

(4) The test will be performed at normal room temperature.

(5) The am signal generator is modulated 30 percent at 400 cps. The fm signal generator is modulated at 400 cps with deviation of 30 kc. Set the receiver controls as follows for each test. When a test requires a different setting, the new one is indicated.

Control	Setting
FREQUENCY BAND	145–300 MC.
BEAT-NOTE BALANCE	OFF.
SENSITIVITY	Maximum clockwise.
TONE	Maximum clockwise.
VOLUME	Midposition.
MVC–AVC–FM	MVC.

(6) A 600-ohm resistor is connected across terminals 6 and 9 of the OUTPUT terminal board of Radio Receivers R–593/GRR and RC–1269–A. The two terminals marked CT are connected together. A 250-ohm resistor is connected across terminals 4 and 6 on the OUTPUT terminal board of Radio Receiver BC–1269.

(7) A dummy antenna consisting of a nonreactive resistor of 49 ohms is connected in series with the output of the signal generator in use.

b. Calibration.

(1) Turn the receiver BEAT-NOTE BALANCE control on. All other controls remain the same as given in *a* above.

(2) Connect the TS–505/U across the correct output terminals on the rear of the receiver.

(3) Set the receiver dial for 150 mc.

(4) Connect a pickup wire to a pin on the ANT 145–300 receptacle on the back of the receiver. Place Frequency Meter TS–186A/UP in the oscillating condition.

(5) Adjust the frequency meter tuning about the 150-mc calibration mark until maximum output is obtained from the receiver as indicated on the multimeter.

(6) Note the dial reading of the frequency meter; it should be within 3 percent for all dial checks.

(7) Repeat the procedure given in (3), (4), and (5) above for a frequency of 275 mc.

(8) Note the dial reading of the frequency meter.

(9) Turn the FREQUENCY BAND switch on the receiver to 300–600 MC.

(10) Rotate the TUNING control of the receiver to the 350-mc calibration mark.

(11) Adjust the frequency meter about its 350-mc mark until maximum output is obtained from the receiver, as indicated on the output meter.

(12) Note the dial reading of the frequency meter.

(13) Repeat the procedures given in (9), (10), and (11) above for the frequency of 550 mc and note the dial reading of the frequency meter.

c. Am Sensitivity.

(1) Turn the receiver BEAT-NOTE BALANCE control to OFF. All other controls should be set as given in *a* above.

(2) Apply an rf voltage from the signal generator, modulated 30 percent at 400 cps to the antenna terminals in series with a 49-ohm nonreactive resistor. For band 1 measurements, make connection to ANT 145–300 connector J2; for band 2 measurements, make connection to ANT 300–600 connector J1. Turn off the modulation and adjust the receiver VOLUME control to obtain a 1.2-volt output with Radio Receivers R–593/GRR and BC–1269–A and an .8-volt output with Radio Receiver BC–1269. The maximum input voltage with modulation required to provide a minimum of 2.4-volt output for the R–593/GRR and the BC–1260–A and 1.6-volt output for the BC–1260 is indicated in the chart below. Refer to *d* below for the signal-plus-noise to noise ratio tests.

Band	Frequency (MC)	Input (maximum in uv)
1	150	10
1	225	10
1	275	10
2	300	20
2	580	40
2	600	60

d. Signal-Plus-Noise to Noise Ratio.

(1) This test is most conveniently made in conjunction with the sensitivity test given in *c* above.

(2) After each portion of each band is tested, turn off the modulation of the signal generator and note the output as indicated on the output meter.

(3) The ratio of the output voltage with modulation on to modulation off should be not less than 2 to 1 for all models of the receiver.

e. Fm Sensitivity. Set the MVC–AVC–FM switch to the FM position. Use Signal Generator AN/URM–70 and perform the test in the same manner as that for am signals. Test the receiver at 300 mc and 400 mc in the hf band instead of 580 mc and 600 mc. The maximum input and minimum output voltages are the same as for the am tests.

f. Selectivity. Set the receiver to 400 mc and the MVC–AVC–FM switch to MVC. Apply a 3,000-uv, am signal at a frequency of 15 mc, using Signal Generator TS–497A/URR, to the receiver antenna receptacle. Adjust the SENSITIVITY and VOLUME controls for a convenient reference output reading. At this point, increase the signal input in steps of 2, 10, and 100 times the initial signal strength. At each step, the signal generator should be detuned to each side of the receiver if until the reference output reading is obtained. Note the frequency changes from the if. for each step. The bandwidth is as follows:

(1) 2 times down: not less than .2 mc nor greater than .5 mc.

(2) 10 times down: not less than .4 mc nor greater than .8 mc.

(3) 100 times down: not less than .6 mc not greater than 1.2 mc.

g. Fm Limiter.

(1) Set the MVC–AVC–FM switch to FM and the FREQUENCY BAND switch to either position; retain other control settings as outlined in *a* above.

(2) Set Electronic Multimeter TS–505/U on the ac volts scale and connect it to the plate (pin 8) of detector-limiter stage V10.

(3) Apply an unmodulated rf signal from Signal Generator TS–497A/URR through

the 49-ohm resistor to the antenna connector on the rear of the receiver which corresponds with the setting of the FREQUENCY BAND switch. Tune in the signal for a maximum reading on the vtvm.

(4) Vary the signal strength from 25 μv to 50,000 μv.

(5) The signal voltage at the limiter plate should vary not more than 20 percent from the maximum value.

h. Discriminator. Set MVC–AVC–FM switch to FM, BEAT-NOTE BALANCE control to OFF, and the FREQUENCY BAND switch to 145–300 MC. Apply an unmodulated 15-mc signal from TS–497A/URR to the grid of the first if. stage. Set the vtvm on the dc volts scale and connect it to the output of the discriminator, pin 4 of V11. *Increase* the frequency of the signal generator until a peak reading is obtained on the vtvm; note the frequency. Tune the signal generator *below* 15 mc until a peak reading is obtained on the vtvm; note the frequency. The bandwidth from the peak-to-peak reading should be 350 kc plus or minus 100 kc. Each peak voltage reading should be displaced from the if. by not more than one-half the bandwidth plus or minus 15 kc.

i. Distortion.

(1) Set the receiver controls as outlined in *a* above.

(2) Connect Spectrum Analyzer TS–723/U across the audio output terminals.

(3) Adjust the 400-cps modulated rf signal input so that an audio output of 34.6 volts is indicated on the spectrum analyzer for Radio Receivers R–593/GRR and BC–1269–A. The BC–1269 should have an output of 22.3 volts.

(4) Adjust the spectrum analyzer to null.

(5) The total distortion should be not greater than 10 percent.

93. Power Supply Tests

a. General Test Conditions.

(1) The tests are made at 115-volts and 230-volts, 60 cps ac, adjusted with Variac CN–164A/U.

(2) Allow the power supply to warm up for 15 minutes.

(3) Connect a 2,200-ohm, 60-watt, high-voltage load resistor across pins A and F of Jack J201 and a jumper from pin C to pin D to complete the switch circuit.

(4) Connect a 4.5-ohm, 60-watt resistor (for 12.6-volt filaments) or a 1.1-ohm, 60-watt resistor (for 6.3-volt filaments) across pins E and B on Jack J201.

(5) Use a 1½-ampere fuse for 230 volts ac supply and a 3-ampere fuse for 115-volts ac.

b. Test Requirements.

(1) Measure the high-voltage output with Multimeter TS–352/U. It should be 250 volts dc plus or minus 15 volts.

(2) Measure the filament voltage output. It should be not less than 6.3 volts ac nor more than 7 volts ac in the 6.3 V position and not less than 12.6-volts ac nor more than 14 volts ac in the 12.6 V position.

(3) Measure the ac ripple voltage with Electronic Multimeter ME–6A/U. It should not exceed .15 volts ac.

(4) Measure the ac input power with Wattmeter TS–430/U. It should not exceed 150 watts.

CHAPTER 6

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

94. Disassembly

The following instructions are recommended as a guide for preparing the radio set for transportation and storage.

a. Power Supply Unit. Disconnect Cords CD–872 and CD–873. Coil the cords and store them in the right-hand compartment of Chest CH–271 (fig. 3). Return Power Supply Unit RA–61–A and Mounting FT–414 to the main compartment of the chest. Close and latch the chest cover.

b. Radio Receiver. Disconnect the two transmission lines (Cords CD–927) from the rear of the *receiver.* Return the receiver and Mounting FT–411–A to the main compartment of Chest CH–270 (fig. 2). If any accessory items were used, return them to the left-hand compartment of the chest. Close and latch the chest cover.

c. Antenna Equipment (fig. 6).

(1) Remove the stakes from the ends of the arm which prevents antenna rotation.
(2) Loosen the guy ropes and disconnect them from their stakes.
(3) Lift the mast assembly from Mast Base MP–66 and carefully lay the assembly on the ground.
(4) Disconnect the two transmission lines (Cords CD–927) from their respective antennas and roll each cord into a coil.
(5) Detach the three guy ropes from the guy ring at the top of the mast.
(6) Remove Antennas AN–169 and AN–170.
(7) Disassemble the mast sections.
(8) Remove the three guy stakes.
(9) Return all the antenna components to Chest CH–269.
(10) Close and latch the chest cover.

95. Field Repackaging Data

a. General. This instruction provides procedures of field packaging, packing, and marking of the subject item for Zone of Interior and intertheater movement. This instruction covers one type of Radio Set SCR–616.

b. Estimated Material Requirements.

Materials	Quantity
Waterproof Barrier Material	110 sq ft.
Paper, single-face, flexible, corrugated	130 sq ft.
Tape, pressure-sensitive	20 sq ft.
Tape, paper, gummed	30 sq ft.
Strapping, flat, steel	31 sq ft.
Shipping boxes, wooden	3

c. Material Requirements of Boxes.

Box No.	Size (in.)	Board (ft)	Volume (cu ft)	Packed weight	Contents
1 of 3	43½ x 21 x 24	35	8	150	Receiver.
3 of 3	36½ x 15¾ x 24	26	6	125	Power supply.
2 of 3	56¼ x 23½ x 20	41	15	200	Antenna.

d. Component Packaging. Package components of Radio Set SCR–616 as follows:

(1) *Technical manuals.* Package each technical manual within a close-fitting bag fabricated of waterproof barrier material. Seal the seams with water-resistant pressure-sensitive tape.
(2) *Headset and cords.* Package each item for mechanical and physical protection only, as follows: Coil each cord and tie

it in three places with cotton tape. Cushion each item by wrapping it in flexible corrugated paper. Secure the cushioning with gummed paper tape.

(3) *Tubes and electrical spare parts.* Package spare tubes and electrical spare parts individually by wrapping them in single-faced flexible corrugated paper and secure with gummed paper tape.

(4) *Storage within Chest CH–270.* Place all items packaged as described in (2) through (3) above within the compartments of Chest CH–270. Place the receiver in Case CS–138 and secure the fastenings. Place and secure the cased receiver to Mounting FT–411. Place and secure the mounted receiver within its designated compartment of Chest CH–270. Block and brace the receiver, as required, with pads of flexible corrugated fiberboard to prevent movement in handling and transit. Fill voids of other compartments with flexible corrugated paper to prevent shifting of contents. Close the lid of the chest and secure the fastenings.

(5) *Chest CH–270 with contents.* Package each chest with the contents as follows: cushion each chest on all surfaces with pads prefabricated of flexible corrugated fiberboard, designed to absorb the shock of impact normally encountered in handling and transit. Place each cushioned chest within a wrap of single-faced flexible corrugated paper. Secure all closures with pressure-sensitive tape.

(6) *Tubes and electrical spare parts.* Package tubes and electrical spare parts as specified in (3) above.

(7) *Cords CD–872 and CD–873.* No packaging is required; merely coil and tie them in three places with cotton tape.

(8) *Storage within Chest CH–271.* Place all items packaged as specified in (6) and (7) above within the compartments of chest CH–271. Place and secure the power supply on Mounting FT–414. Place, secure, and block the mounted power supply within Chest CH–271 as described in (4) above. Close the lid and secure the fastenings.

(9) *Chest CH–271 with contents.* Package each chest, with the contents, as described in (5) above.

(10) *Antenna equipment RC–281.* Package the components of the antenna equipment for mechanical and physical protection only, as follows: wind each cord and guy into a coil of proportionate dimensions and tie it in three places with cotton tape. Cushion the items by wrapping them in flexible, corrugated paper as required to prevent damage in handling and transit. Secure the cushioning with gummed paper tape.

(11) *Storage within Chest CH–269.* Place all items packaged as specified in (10) above within Chest CH–269. Fill all voids with pads of flexible corrugated paper to prevent shifting. Close the lid of the chest and secure the fastenings.

(12) *Chest CH–269 with contents.* Package each Chest CH–269 with the contents as described in (5) above.

e. Packing.

(1) Place each packaged chest within individual nailed wooden boxes.

(2) Shipping containers should be fitted with a sealed waterproof case liner.

(3) Strap shipping containers on intertheater movements only.

(4) Arrange the boxes containing components of Radio Set SCR–616, packed as specified above, in the following sequence:

Chest CH–270 containing Radio Receiver BC–1269, BC–1269–A, or R–593/GRR. Box No. 1 of 3.

Chest CH–269 containing Antenna Equipment RC–281. Box No. 2 of 3.

Chest CH–271 containing Power Supply Unit RA–61. Box No. 3 of 3.

(5) Mark shipping containers in accordance with SR 55–720–1, Section II, Transportation and Travel, Preparation for Oversea Movement of Units (POM).

Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

96. General

The demolition procedures outlined in paragraph 97 will be used to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished only upon order of the commander.

97. Methods of Destruction

a. Smash. Smash the controls, tubes, coils, switches, capacitors, transformers, and headsets; use sledges, axes, handaxes, pickaxes, hammers, crowbars, or heavy tools.

b. Cut. Cut cords, headsets, and wiring; use axes, handaxes, or machetes.

c. Burn. Burn cords, resistors, capacitors, coils, wiring, and technical manuals; use gasoline, kerosene, oil, flame throwers, or incendiary grenades.

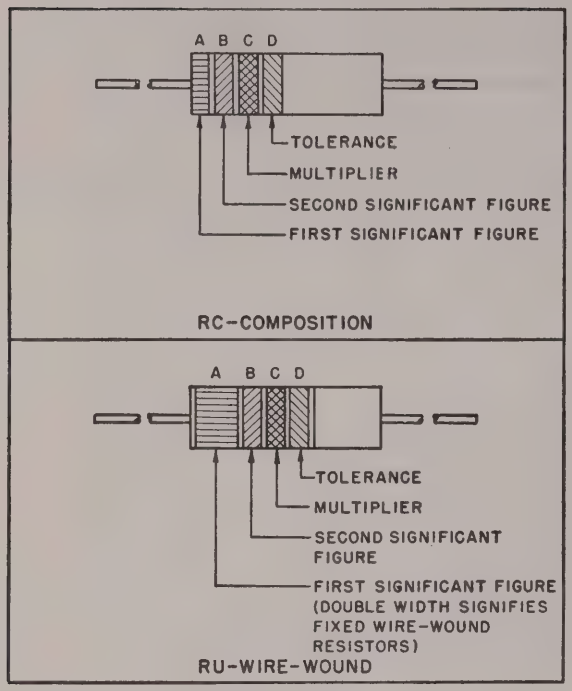
d. Bend. Bend panels, cabinet, and chassis.

e. Explode. If explosives are necessary, use firearms, grenades, or TNT.

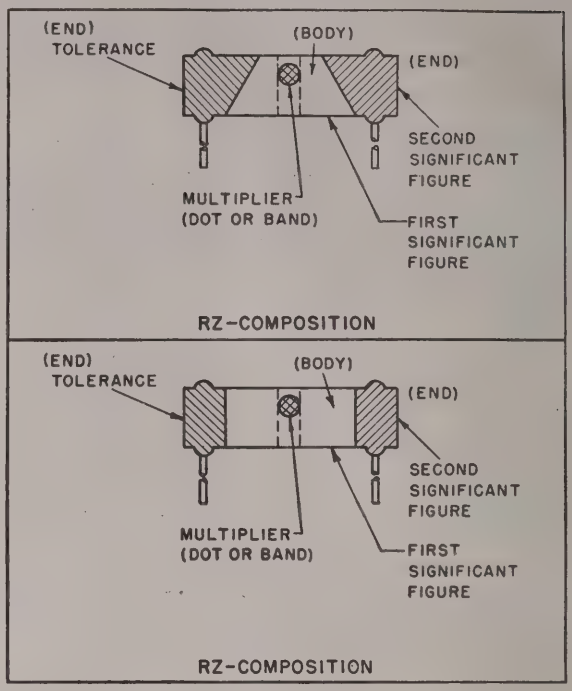
f. Dispose. Bury or scatter the destroyed parts in slit trenches, foxholes, or throw them into streams.

RESISTOR COLOR CODE MARKING
(MIL-STD RESISTORS)

AXIAL-LEAD RESISTORS (INSULATED)



RADIAL-LEAD RESISTORS (UNINSULATED)



RESISTOR COLOR CODE

BAND A OR BODY*		BAND B OR END*		BAND C OR DOT OR BAND*		BAND D OR END*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1	BODY	± 20
BROWN	1	BROWN	1	BROWN	10	SILVER	± 10
RED	2	RED	2	RED	100	GOLD	± 5
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000		
GREEN	5	GREEN	5	GREEN	100,000		
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	GOLD	0.1		
WHITE	9	WHITE	9	SILVER	0.01		

*FOR WIRE-WOUND-TYPE RESISTORS, BAND A SHALL BE DOUBLE-WIDTH. WHEN BODY COLOR IS THE SAME AS THE DOT (OR BAND) OR END COLOR, THE COLORS ARE DIFFERENTIATED BY SHADE, GLOSS, OR OTHER MEANS.

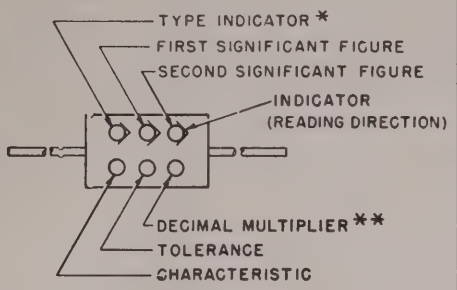
EXAMPLES (BAND MARKING):
10 OHMS ±20 PERCENT: BROWN BAND A; BLACK BAND B; BLACK BAND C; NO BAND D.
4.7 OHMS ±5 PERCENT: YELLOW BAND A; PURPLE BAND B; GOLD BAND C; GOLD BAND D.

EXAMPLES (BODY MARKING):
10 OHMS ±20 PERCENT: BROWN BODY; BLACK END; BLACK DOT OR BAND; BODY COLOR ON TOLERANCE END.
3,000 OHMS ±10 PERCENT: ORANGE BODY; BLACK END; RED DOT OR BAND; SILVER END.

STD-R1

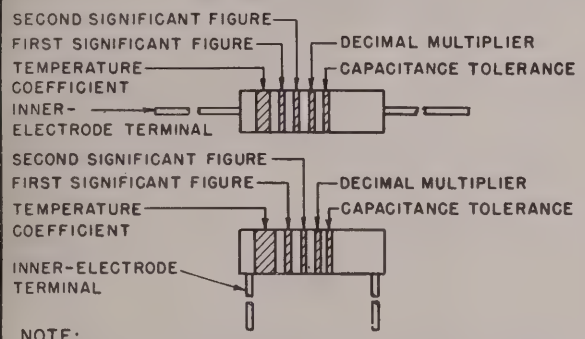
Figure 43. MIL-STD resistor color codes.

CAPACITOR COLOR CODE MARKING
(MIL-STD CAPACITORS)



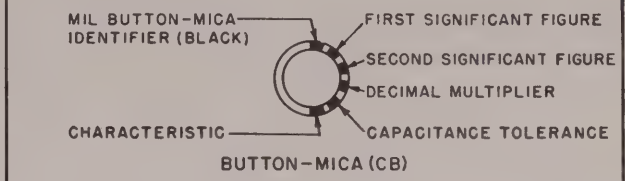
* BLACK DOT: MICA DIELECTRIC
SILVER DOT: PAPER DIELECTRIC
**INDICATES NUMBER OF ZEROS ON PAPER TYPE.

MICA (CM) AND PAPER (CN)

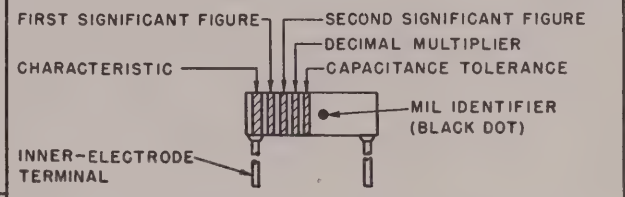


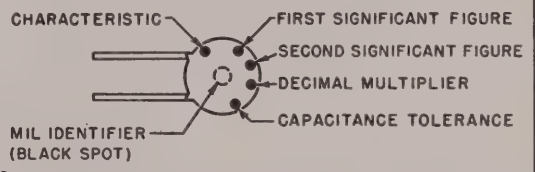
NOTE:
SPOTS MAY BE USED INSTEAD OF BANDS; TEMPERATURE COEFFICIENT MARKING IS LARGER.

CERAMIC-TEMPERATURE COMPENSATING (CC)



BUTTON-MICA (CB)





NOTES:
1. SPOTS MAY BE USED ON TUBULAR CAPACITORS; CHARACTERISTIC SPOT IS LARGER AND MIL IDENTIFIER IS ON SIDE DIAMETRICALLY OPPOSITE COLOR SPOTS.
2. MIL IDENTIFIER OF DISK TYPE IS ON REVERSE SIDE; CHARACTERISTIC SPOT IS LARGER OR SPACE BETWEEN CHARACTERISTIC AND TOLERANCE SPOTS IS THREE TIMES SPACE BETWEEN ADJACENT SPOTS.
3. TOLERANCE: YELLOW, +100%, -20%.

CERAMIC-GENERAL PURPOSE (CK)

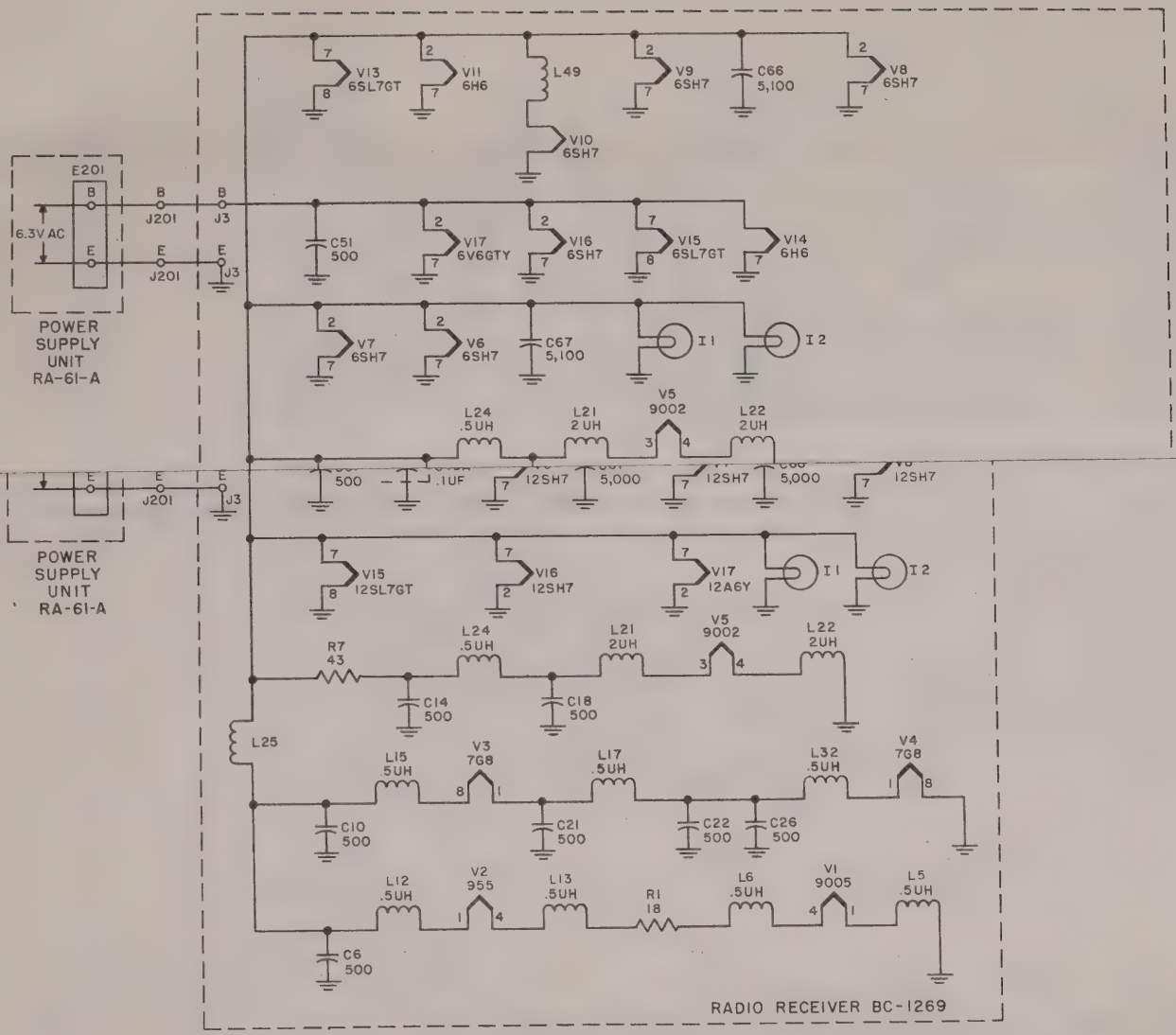
CAPACITOR COLOR CODE

COLOR	SIG FIG.	MULTIPLIER		CHARACTERISTIC[1]				TOLERANCE[2]					TEMPERATURE COEFFICIENT (UUF/UF/°C)
		DECIMAL	NUMBER OF ZEROS	CM	CN	CB	CK	CM	CN	CB	CC		
											OVER 10UUF	10UUF OR LESS	CC
BLACK	0	1	NONE		A			20	20	20	20	2	ZERO
BROWN	1	10	1	B	E	B	W				1		-30
RED	2	100	2	C	H		X	2		2	2		-80
ORANGE	3	1,000	3	D	J	D			30				-150
YELLOW	4	10,000	4	E	P								-220
GREEN	5		5	F	R						5	0.5	-330
BLUE	6		6		S								-470
PURPLE (VIOLET)	7		7		T	W							-750
GRAY	8		8			X						0.25	+30
WHITE	9		9								10	1	-330(±500)[3]
GOLD		0.1						5		5			+100
SILVER		0.01						10	10	10			

1. LETTERS ARE IN TYPE DESIGNATIONS GIVEN IN MIL-C SPECIFICATIONS.
2. IN PERCENT, EXCEPT IN UUF FOR CC-TYPE CAPACITORS OF 10 UUF OR LESS.
3. INTENDED FOR USE IN CIRCUITS NOT REQUIRING COMPENSATION.

STD-CI

Figure 44. MIL-STD capacitor color codes.


E201
B
E
6.3V AC
B
J201
E
J201
B
J3
E
J3
POWER SUPPLY UNIT RA-61-A
V13 6SL7GT
V11 6H6
L49
V10 6SH7
V9 6SH7
C66 5,100
V8 6SH7
C51 500
V17 6V6GTY
V16 6SH7
V15 6SL7GT
V14 6H6
V7 6SH7
V6 6SH7
C67 5,100
I1
I2
V5 9002
L24 .5UH
L21 2UH
L22 2UH
500
.1UF
12SH7
5,000
12SH7
5,000
12SH7
V15 12SL7GT
V16 12SH7
V17 12A6Y
I1
I2
R7 43
C14 500
C18 500
L25
L15 .5UH
V3 7G8
L17 .5UH
L32 .5UH
V4 7G8
C10 500
C21 500
C22 500
C26 500
L12 .5UH
V2 955
L13 .5UH
R1 18
L6 .5UH
V1 9005
L5 .5UH
C6 500
RADIO RECEIVER BC-1269

TM 260-105

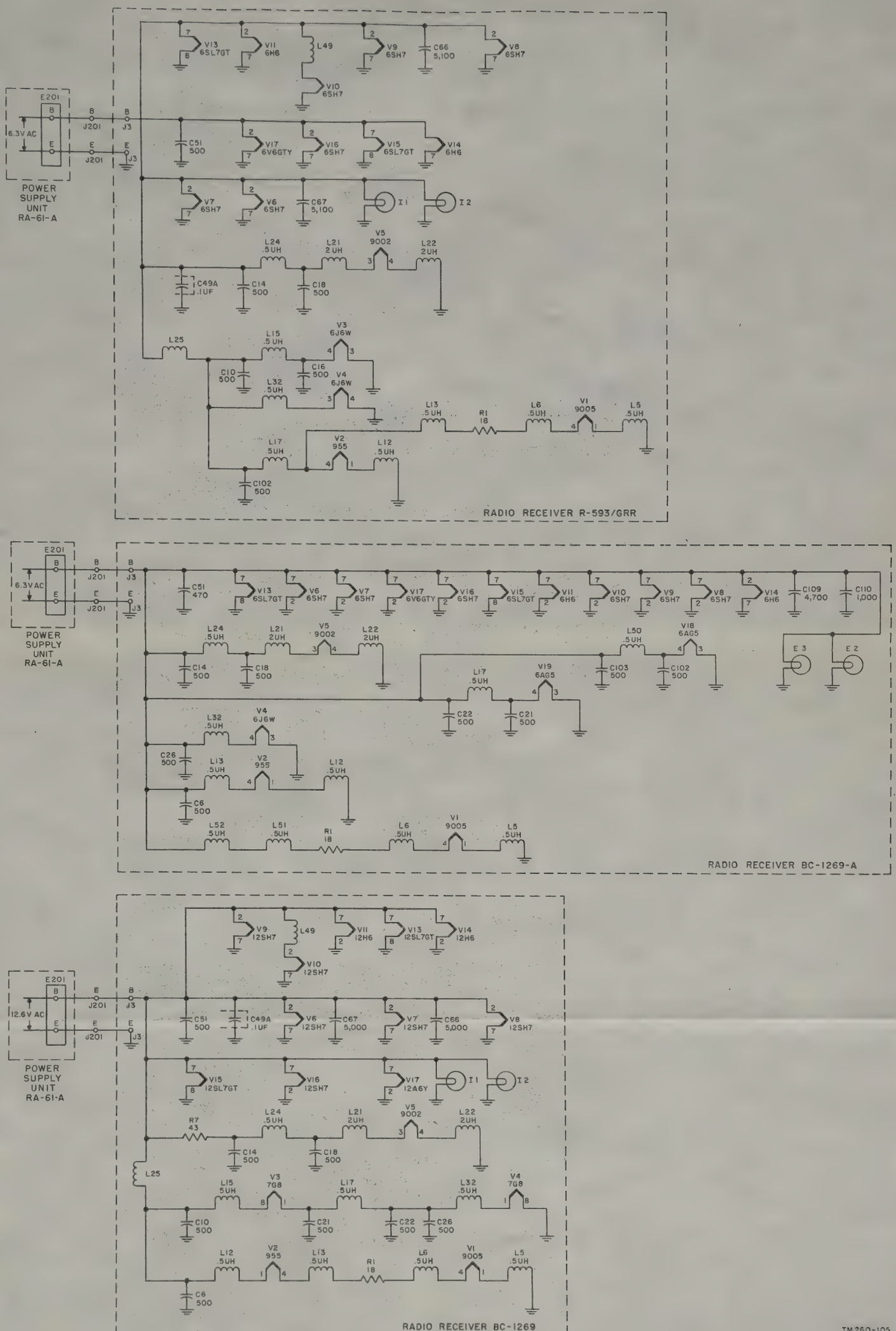
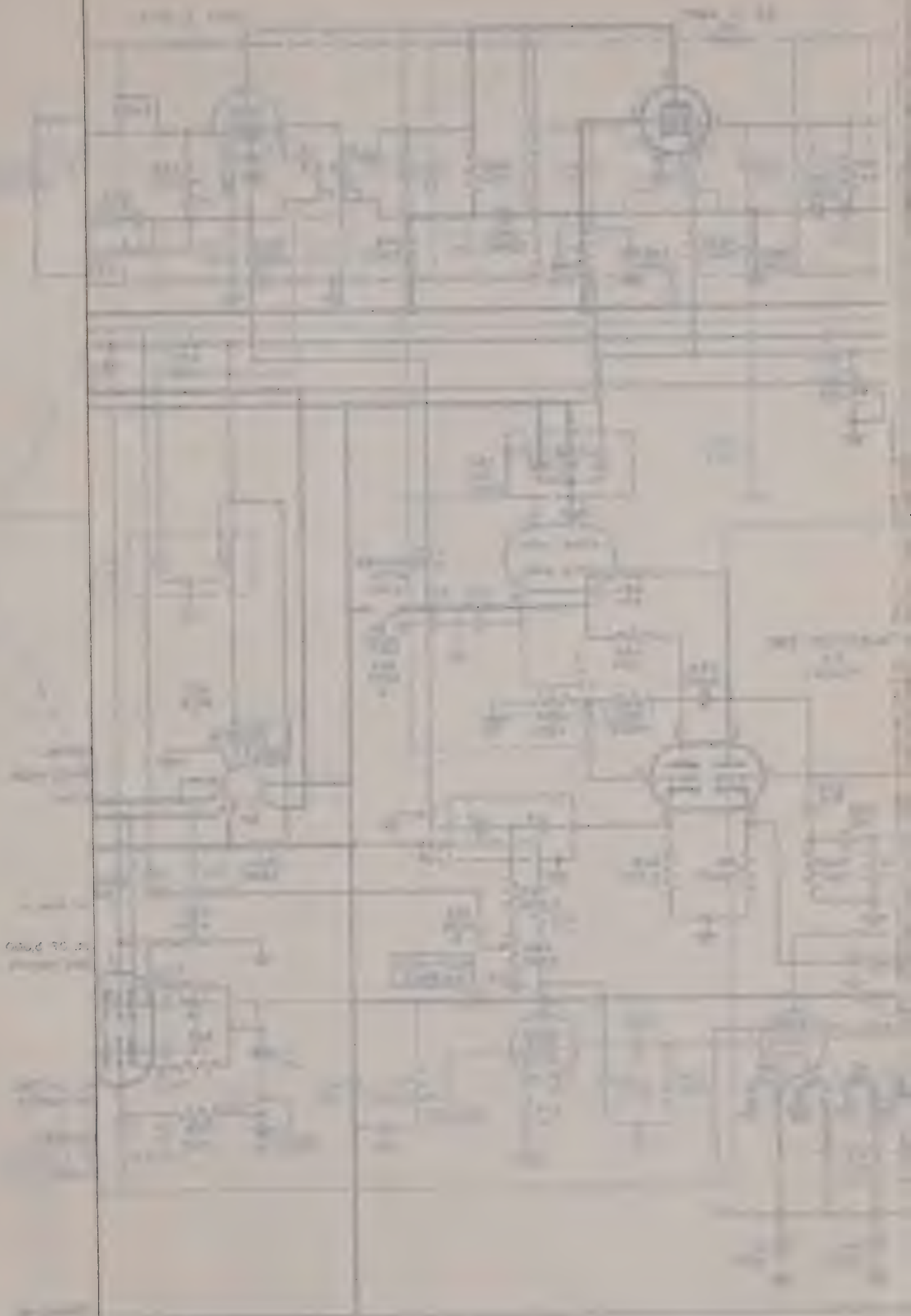


Figure 45. Receiver filament circuits.



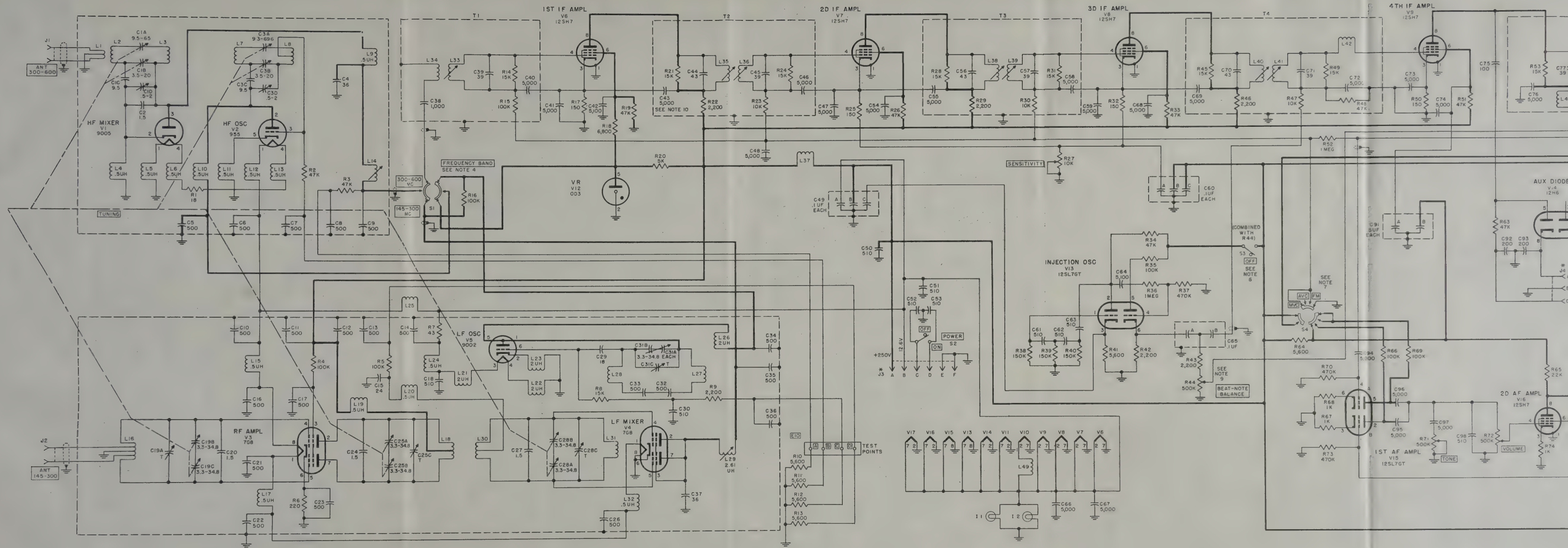
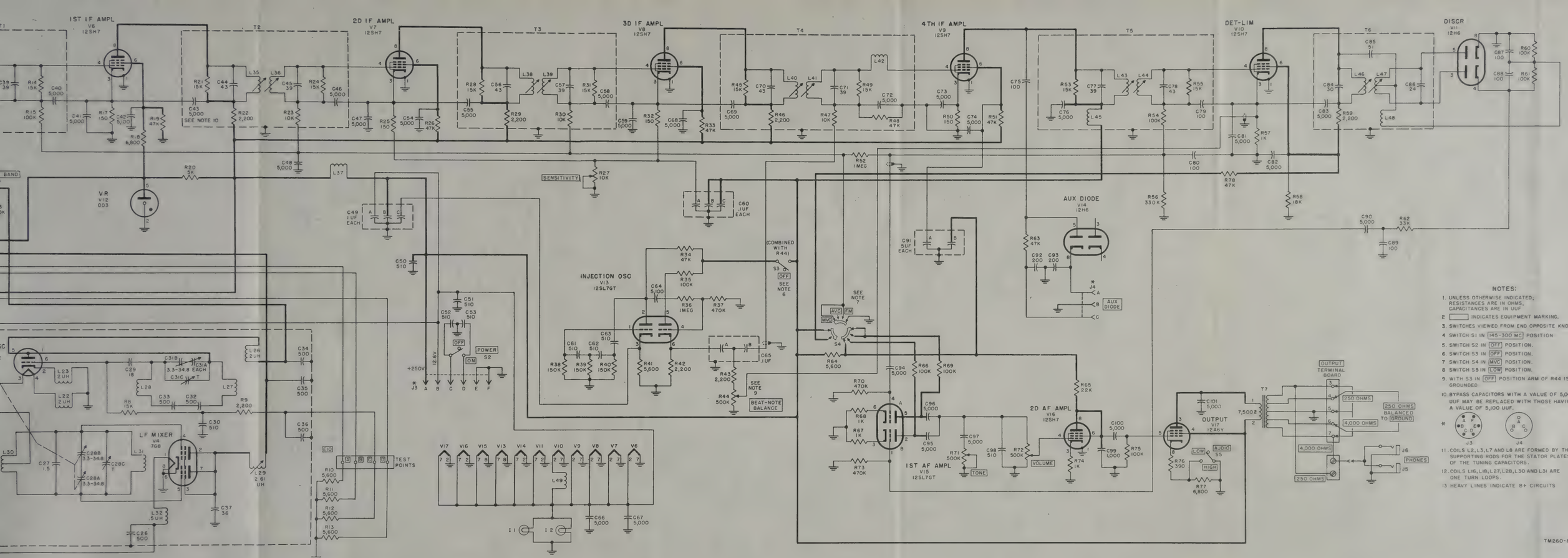


Figure 46. Radio Receiver BC-1269, schematic diagram.



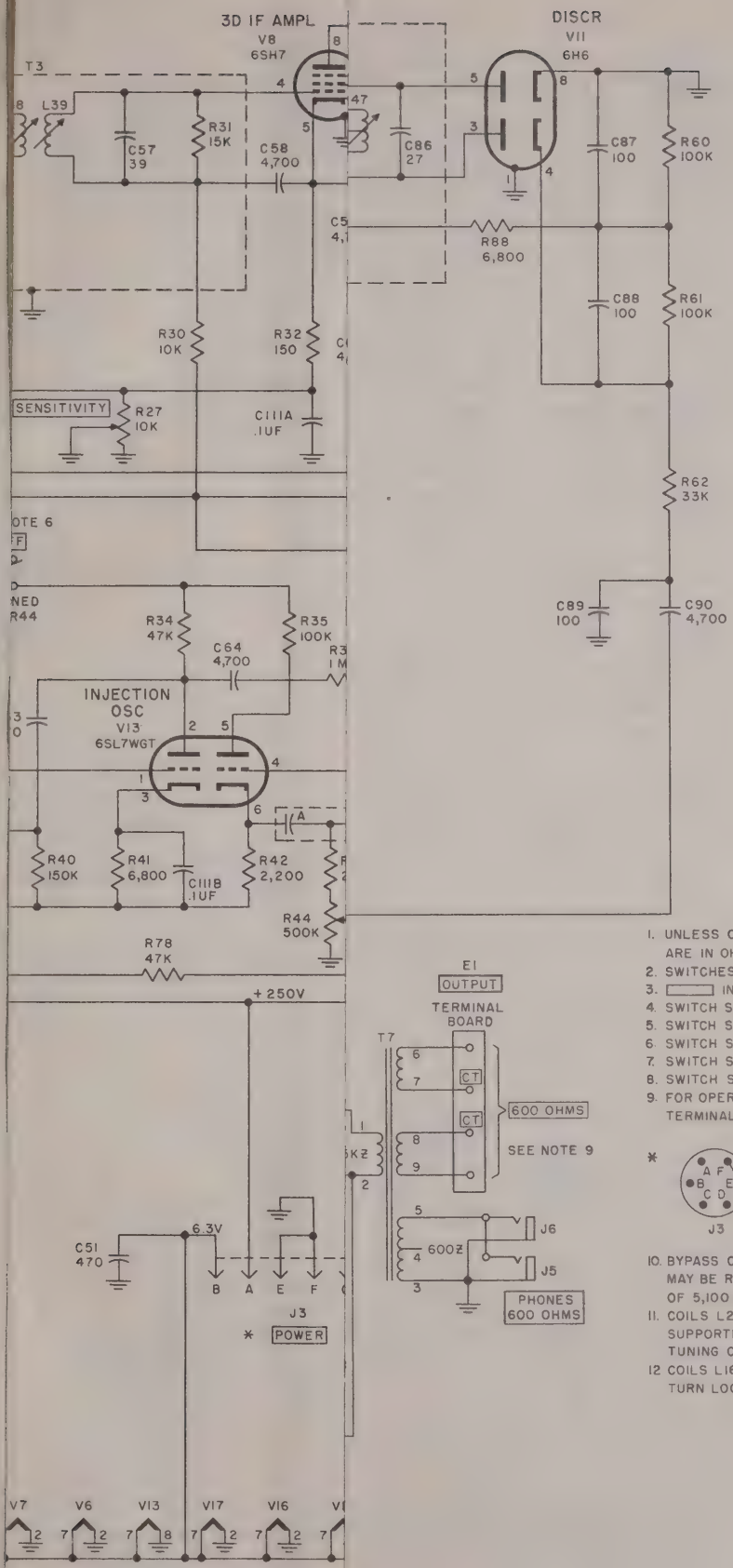
NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UUF.
2. ▭ INDICATES EQUIPMENT MARKING.
3. SWITCHES VIEWED FROM END OPPOSITE KNOB.
4. SWITCH S1 IN 145-300 MC POSITION.
5. SWITCH S2 IN OFF POSITION.
6. SWITCH S3 IN OFF POSITION.
7. SWITCH S4 IN MVC POSITION.
8. SWITCH S5 IN LOW POSITION.
9. WITH S3 IN OFF POSITION ARM OF R44 IS GROUNDED.
10. BYPASS CAPACITORS WITH A VALUE OF 5,000 UUF MAY BE REPLACED WITH THOSE HAVING A VALUE OF 5,100 UUF.

11. COILS L2, L3, L7 AND L8 ARE FORMED BY THE SUPPORTING RODS FOR THE STATOR PLATES OF THE TUNING CAPACITORS.
12. COILS L46, L48, L37, L28, L30 AND L31 ARE ONE TURN LOOPS.
13. HEAVY LINES INDICATE B+ CIRCUITS

TM260-88

Figure 48. Radio Receiver BC-1269, schematic diagram.



NOTES:

1. UNLESS OTHERWISE INDICATED; RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UUF.
2. SWITCHES ARE VIEWED FROM END OPPOSITE KNOB.
3. [ ] INDICATES EQUIPMENT MARKING.
4. SWITCH S1 IN [300-600 MC] POSITION.
5. SWITCH S2 IN [OFF] POSITION.
6. SWITCH S3 IN [OFF] POSITION.
7. SWITCH S4 IN [FM] POSITION.
8. SWITCH S5 IN [LOW] POSITION.
9. FOR OPERATION WITH 600-OHM LINE, JUMPER [CT] TERMINALS ON [OUTPUT] TERMINAL BOARD.

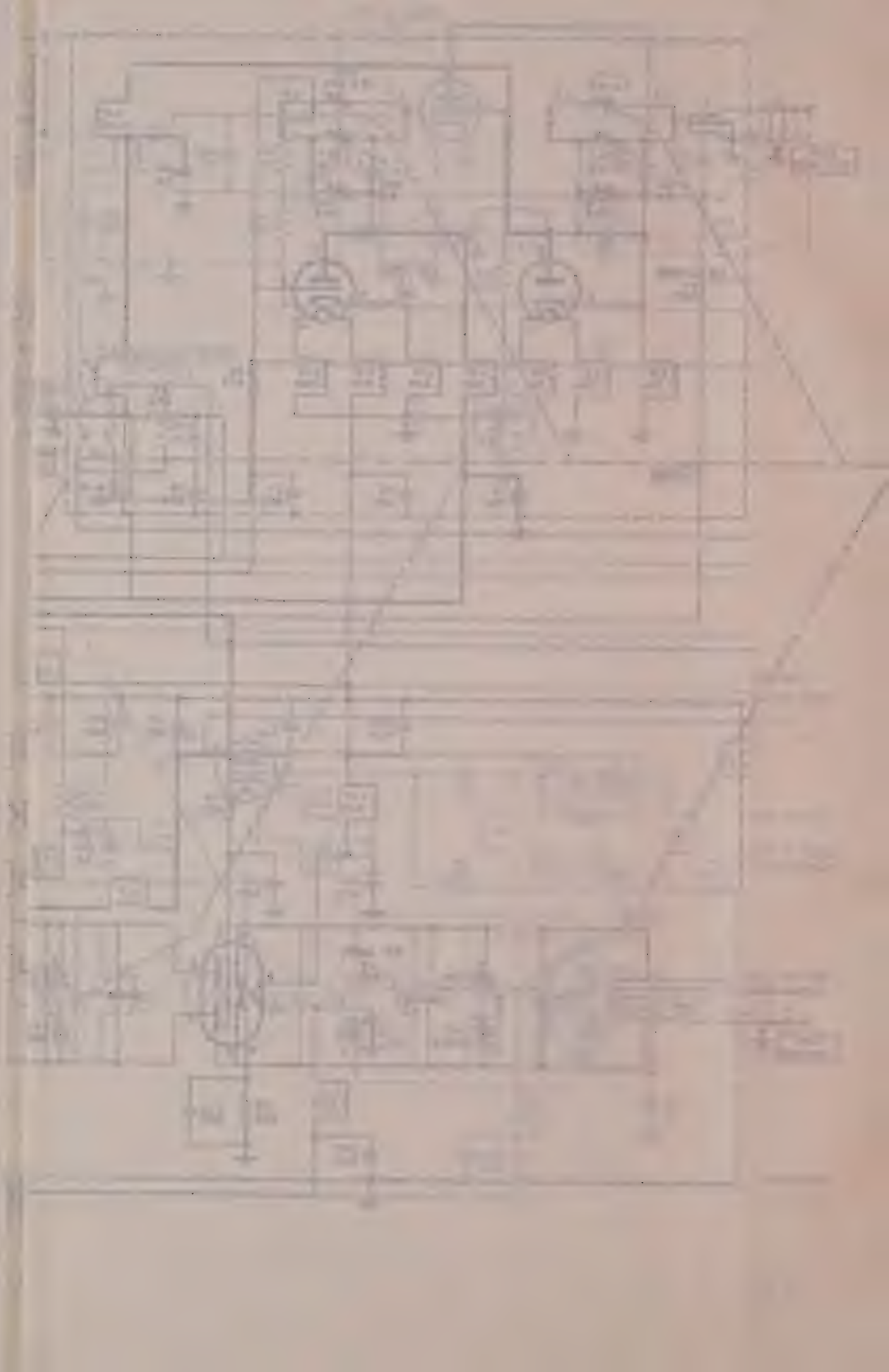
* J3 J4

10. BYPASS CAPACITORS WITH A VALUE OF 4,700 UUF MAY BE REPLACED WITH THOSE HAVING A VALUE OF 5,100 UUF
11. COILS L2, L3, L7, AND L8 ARE FORMED BY THE SUPPORTING ROD FOR THE STATOR PLATE OF THE TUNING CAPACITORS.
12. COILS L16, L18, L27, L28, L30 AND L31 ARE ONE TURN LOOPS.

TM260-89

370655 O - 56(Face p. 80) No. 3

Radio Receiver BC-1269-A, schemat



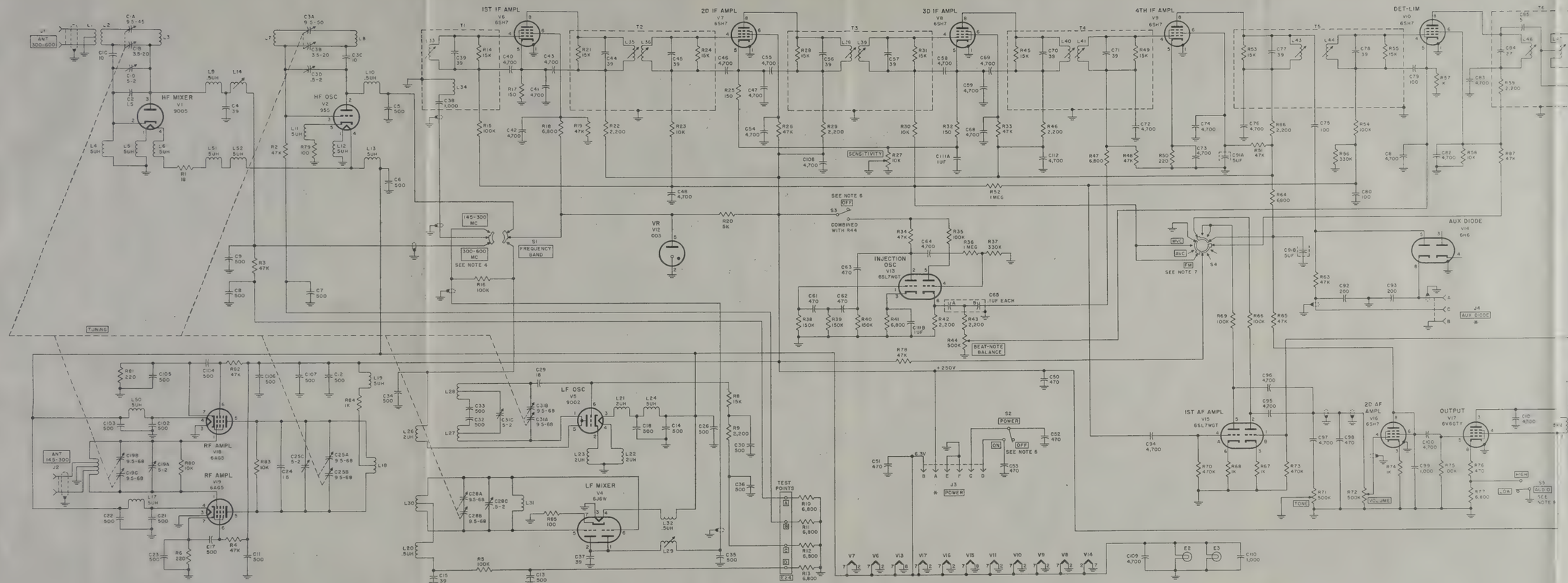
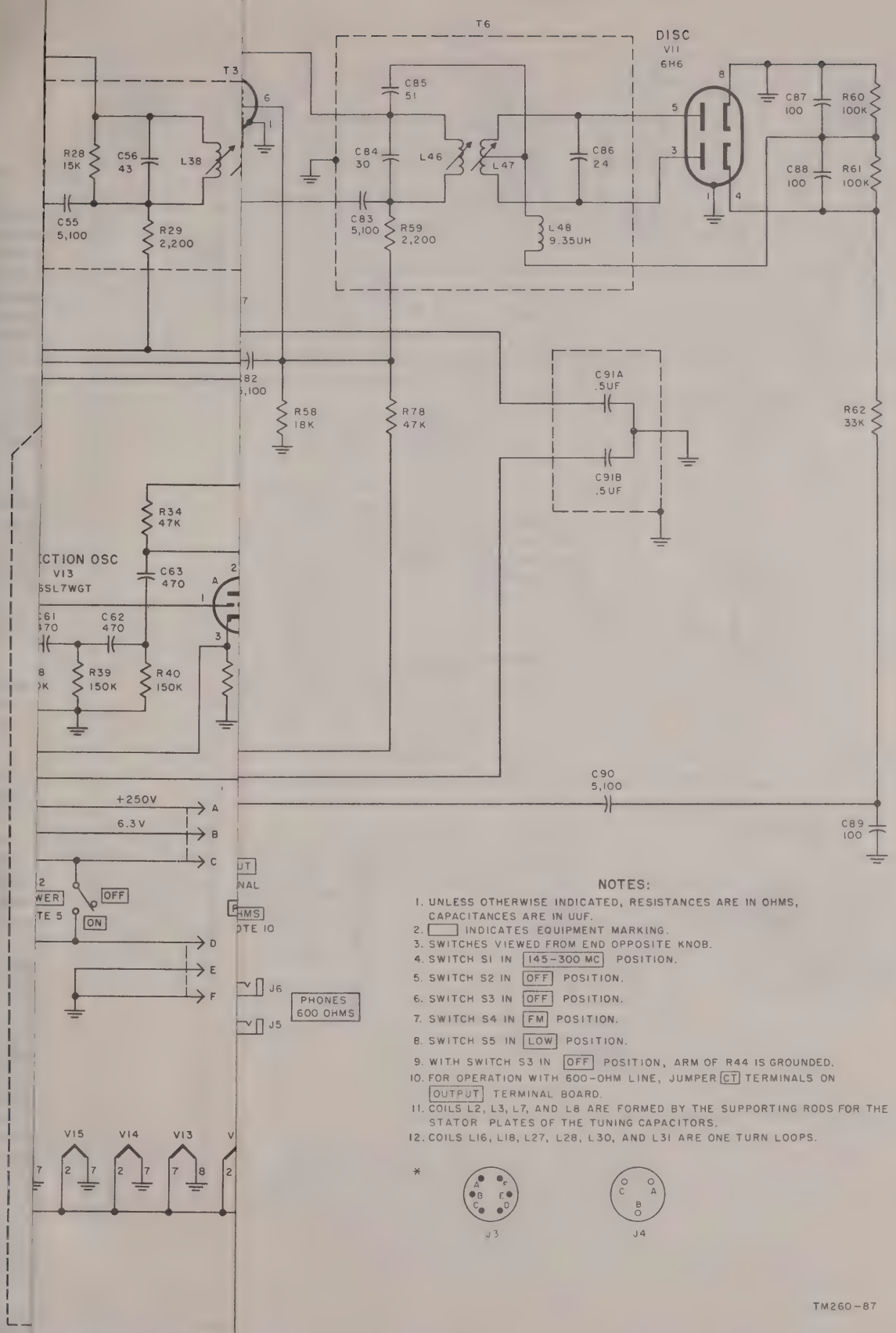

1ST IF AMPL
2D IF AMPL
3D IF AMPL
4TH IF AMPL
DET-LIM
DISCR
HF MIXER
HF OSC
RF AMPL
LF OSC
LF MIXER
INJECTION OSC
1ST AF AMPL
2D AF AMPL
OUTPUT
AUX DIODE
SENSITIVITY
BEAT-NOTE BALANCE
TUNING
TEST POINTS
NOTES
UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UUF.
SWITCHES ARE VIEWED FROM END OPPOSITE KNOB.
INDICATES EQUIPMENT MARKING.
SWITCH S1 IN 300-600 MC POSITION.
SWITCH S2 IN OFF POSITION.
SWITCH S3 IN OFF POSITION.
SWITCH S4 IN FM POSITION.
SWITCH S5 IN LOW POSITION.
FOR OPERATION WITH 600-OHM LINE, JUMPER TERMINALS ON OUTPUT TERMINAL BOARD.
10 BYPASS CAPACITORS WITH A VALUE OF 4,700 UUF MAY BE REPLACED WITH THOSE HAVING A VALUE OF 5,100 UUF.
11 COILS L2, L3, L7, AND L8 ARE FORMED BY THE SUPPORTING ROD FOR THE STATOR PLATE OF THE TUNING CAPACITORS.
12 COILS L6, L8, L27, L28, L29, AND L31 ARE ONE TURN LOOPS.

Figure 47. Radio Receiver BC–1269–A, schematic diagram.



NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UUF.
2. [ ] INDICATES EQUIPMENT MARKING.
3. SWITCHES VIEWED FROM END OPPOSITE KNOB.
4. SWITCH S1 IN [145-300 MC] POSITION.
5. SWITCH S2 IN [OFF] POSITION.
6. SWITCH S3 IN [OFF] POSITION.
7. SWITCH S4 IN [FM] POSITION.
8. SWITCH S5 IN [LOW] POSITION.
9. WITH SWITCH S3 IN [OFF] POSITION, ARM OF R44 IS GROUNDED.
10. FOR OPERATION WITH 600-OHM LINE, JUMPER [CT] TERMINALS ON [OUTPUT] TERMINAL BOARD.
11. COILS L2, L3, L7, AND L8 ARE FORMED BY THE SUPPORTING RODS FOR THE STATOR PLATES OF THE TUNING CAPACITORS.
12. COILS L16, L18, L27, L28, L30, AND L31 ARE ONE TURN LOOPS.

*

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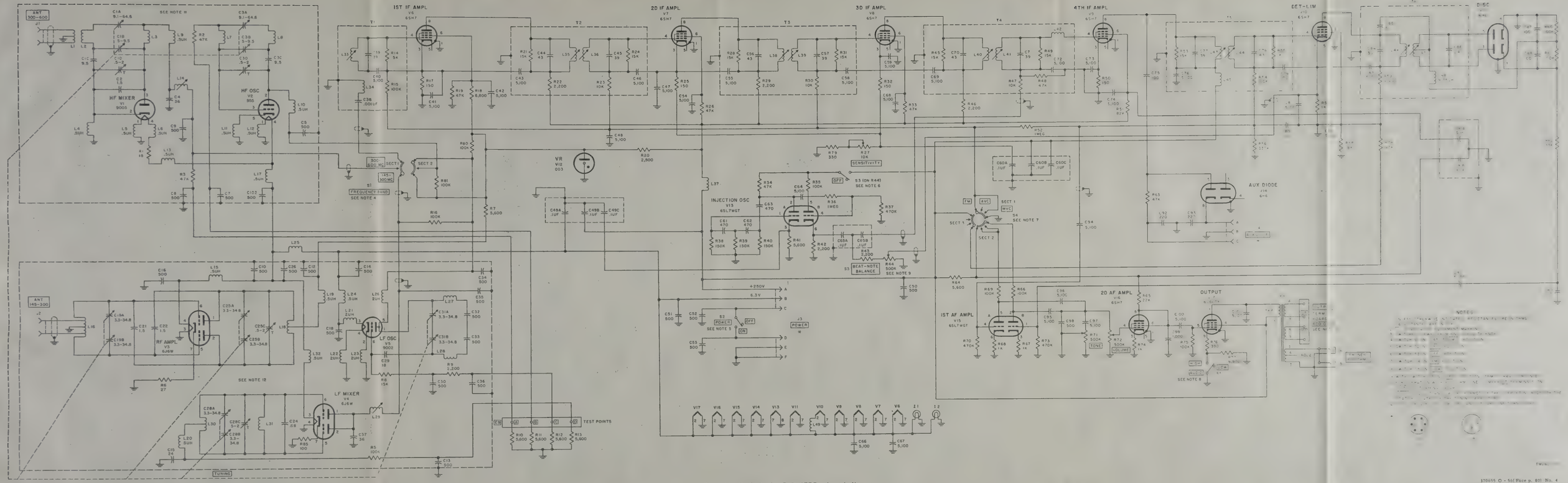
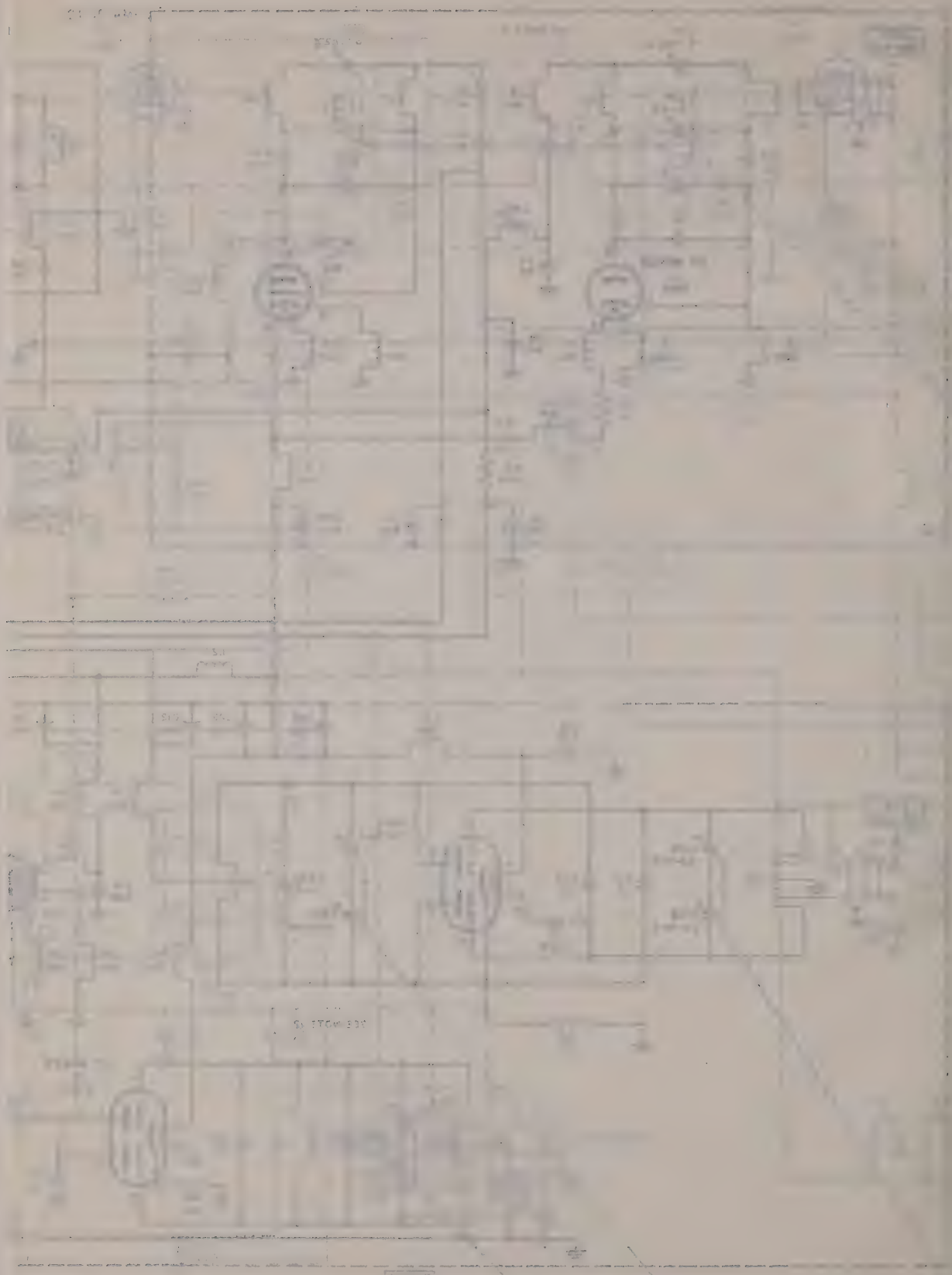


Figure 48. Radio Receiver R-593/GRR, schematic diagram.



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[AG 413.44 (6 Dec 55)]

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